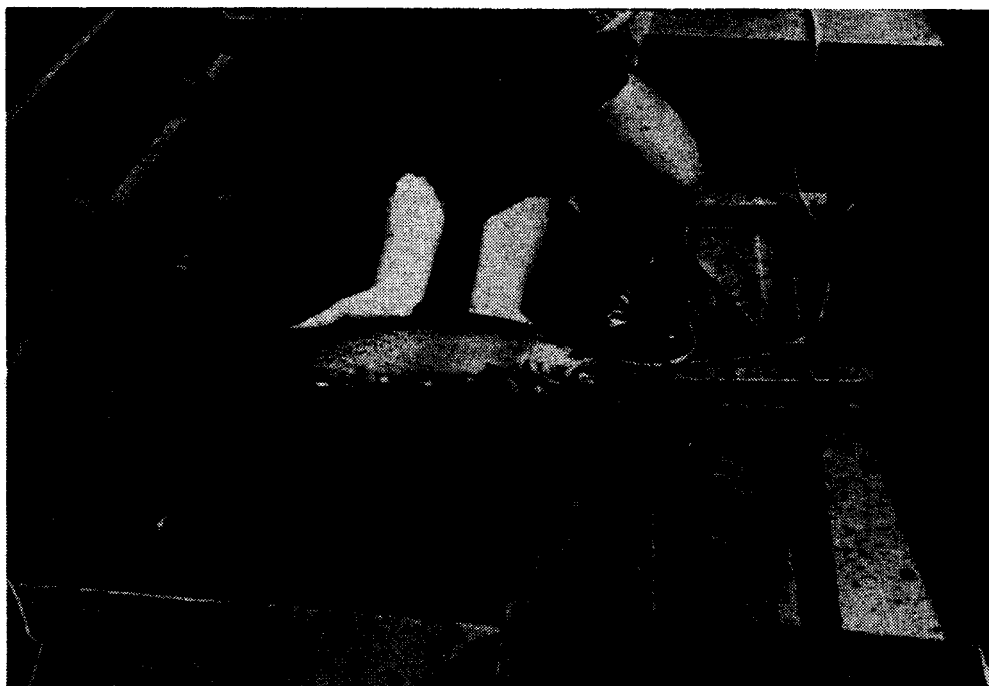


FISHERY RESEARCH



FEDERAL AID IN FISH RESTORATION

Study Completion Report, Project F-73-R-10
Subproject IV: RIVERS AND STREAMS INVESTIGATIONS
Study IV: North Idaho Streams Fishery Research
Job 1: Fish Population Inventory-
Job 2: Fish Habitat Description
Job 3: Fish Species and Stock Evaluation



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And
St. Joe and St. Maries Rivers Limnology Update - 1987
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July 1988

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JOB COMPLETION REPORT

State of: Idaho Name: RIVER AND STREAM INVESTIGATIONS
Project No.: F-73-R-10 Title: North Idaho Streams Fishery Research
Subproject No.: IV
Study No.: IV
Job No.: 1. Fish Population Inventory
Period Covered: March 1, 1987 to February 29, 1988

ABSTRACT

Random stratified creel surveys were conducted on the Coeur d'Alene River in 1986, and on the St. Joe and St. Maries rivers in 1987, during the first five weeks of the fishing season (May 24 through June 30, 1986 and May 24 through June 26, 1987). Twenty-two percent of cutthroat trout harvested from the Coeur d'Alene River were longer than 350 mm (mean length of trapped spawning cutthroat trout was 353 mm). Cutthroat trout comprised 55% and kokanee 23% of the overall harvest. Eleven percent of cutthroat trout harvested from the St. Joe River were longer than 350 mm. Cutthroat trout comprised 66% and rainbow trout 25% of the harvest. Nine percent of cutthroat trout harvested from St. Maries River were longer than 350 mm. Rainbow trout comprised 71% and cutthroat trout 25% of the harvest. Seventy, 78, and 63% of the cutthroat trout harvested from the Coeur d'Alene, St. Joe, and St. Maries rivers, respectively, were taken during the first two weeks of the season.

The lower St. Joe and St. Maries rivers do not support trout fisheries through summer because of high water temperatures; however, lower reaches of cooler tributaries were used by adult trout during summer. The lower Coeur d'Alene River does not experience severe summer temperatures and does support a trout fishery throughout the season. Mountain whitefish are the dominate salmonid in all three rivers. Northern squawfish were found throughout the study sections of the St. Joe and St. Maries rivers.

A tagging study was used to document movement of cutthroat, rainbow, and cutthroat-rainbow hybrid trout. The majority of cutthroat trout tagged in the lower Coeur d'Alene River remained there. Cutthroat trout in the St. Joe River tended to be downstream in the fall through spring and upstream in the summer.

Coeur d'Alene River tributaries support populations of cutthroat, rainbow, cutthroat-rainbow hybrid, and brook trout. Natural rainbow trout and hybrids are more scarce in the St. Joe River drainage and rare in the St. Maries River system. Trout densities in the lower Coeur d'Alene River

tributaries are comparable to those in Pend Oreille and Priest river drainages. The lower St. Joe and St. Maries river tributaries have generally depressed densities of trout.

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INTRODUCTION

A general decline in trout populations and in trout harvest in Lake Coeur d'Alene and its tributaries has been documented over the past 20 years. Three major causes for these reductions are habitat loss or degradation, overexploitation, and competition from introduced species.

Waste from largescale mining activities on the South Fork Coeur d'Alene River, which began in the late nineteenth century and continued until 1982, devastated life in the Coeur d'Alene River (Ellis 1932). Fish populations in the river have slowly increased with closing of the Bunker Hill mine (Kreizenbeck 1973; Bowler 1974; Bauer 1975; Horton 1985, 1986). Increased utilization of the river by game fish has been followed by increased angler harvest. Concern is now expressed by fishery managers over the number of westslope cutthroat trout Salmo clarki lewisi being harvested in late spring.

Bowler (1974)., Goodnight and Mauser (1977), and Lewynsky (1986) evaluated abundance, population structure, and harvest of game fish in the Coeur d'Alene River upstream from the South Fork. Bauer (1975) identified spawning runs of cutthroat trout in several tributaries to the lower Coeur d'Alene River and conducted a limited tagging study in the mainstem Coeur d'Alene River system. Prior to the present study, no structured information had been compiled on the lower river and its tributaries.

Fish populations in the St. Joe River and its tributaries have been studied over the past 25 years. Averett (1962) identified both adfluvial and resident races of cutthroat trout in the St. Joe River drainage that were separated geographically. Averett reported slower growing resident and fluvial cutthroat trout inhabiting the river and tributaries upstream from Avery and a faster growing adfluvial race inhabiting the lower 120 km river and lake complex.

Rankel (1971) investigated the upper and lower St. Joe River and concluded that populations of cutthroat trout were relatively small, that soon after fish entered the river from tributaries they were harvested, and that angling caused a significant portion of the annual mortality. Rankel also concluded that the drainage was inadequately seeded with cutthroat trout fry and that few fish survived long enough to mature and spawn. Mauser (1972), Athearn (1973), and Bjornn and Athearn (1974) experimented with stocking different strains of cutthroat trout fry in Beaver Creek, an upper St. Joe River tributary. Ortmann (1973) and Goodnight and Mauser (1974) observed increased catch rates following stocking of catchable-sized cutthroat trout and rainbow trout Salmo gairdneri in the lower St. Joe River.

Angler preference played a major role in establishing special fishing regulations in the St. Joe River (Rankel 1971; Bjornn 1975; Johnson and Bjornn 1978). Increased game fish abundance and catch rates were observed in the St. Joe River following restrictive harvest regulations and tributary closures (Ortmann 1972, 1973; Bjornn and Athearn 1974; Bjornn and Thurow 1974; Johnson and Bjornn 1975, 1978; Thurow and Bjornn 1975; Walch and Mauser 1976; Johnson 1977; Thurow and Bjornn 1978).

Investigations of the St. Joe River also focused on the biology and control of northern squawfish Ptychocheilus oregonensis populations (Jeppson 1957, 1960; Jeppson and Platts 1959; Falter 1969; Reid 1971) and the development and use of a selective toxin (SQUOXIN) (MacPhee and Ruelle 1969; MacPhee and Reid 1971; Ortmann 1972, 1973; Goodnight and Mauser 1974; Goodnight 1975).

The entire St. Maries River has received only cursory study. In 1972, 31,200 brown trout Salmo trutta fingerlings were stocked. In 1973, the lower 45 km of the river was treated with SQUOXIN, then immediately planted with 10,000 brown trout fingerlings (Goodnight and Mauser 1974). Low numbers of these trout were observed one and two years following stocking. A few anonymous reports of brown trout being caught were received by the Department.

In 1984, the Idaho Department of Fish and Game initiated an inventory of fish populations and harvest in the lower Coeur d'Alene and St. Joe rivers and tributaries. An identical inventory was conducted on the St. Maries River and selected tributaries from the confluence of the Middle Fork St. Maries River and Merry Creek to the mouth.

OBJECTIVE

To assess the status of the game fish populations in the St. Maries, the lower St. Joe, and the lower Coeur d'Alene river systems.

RECOMMENDATIONS

Depressed bull trout populations in the study areas warrants a harvest closure on this species throughout the Coeur d'Alene, St. Joe, and St. Maries river drainages.

Most cutthroat trout harvested 1985 through 1987 were immature. The mean length of mature cutthroat trout in the Coeur d'Alene River drainage was 353 mm, and the majority of first-time spawning cutthroat trout were smaller than 380 mm. We recommend a minimum length restriction of 355 mm (14") to 380 mm (15") be placed on cutthroat trout in all three rivers. To further enhance spawner escapement and distribute harvest, we recommend a one cutthroat trout limit. Any greater limit would increase mortality to an unacceptable level.

Cutthroat trout longer than 200 mm (8") that are found in tributaries during fishing season are predominately resident fish that will not be recruited to the river or lake fisheries. We recommend harvest of tributary trout larger than 200 mm be allowed.

Approximately 1,500 cutthroat trout were harvested in the Coeur d'Alene River below the South Fork during the first month of the season (May 23 through June 30). A late season opening of July 1 would remove this "hot spot" fishery.

We recommend that harvest be monitored during the first four weeks of the fishing season following regulation changes. Additional monitoring should be done on the Coeur d'Alene River to determine distribution of harvest throughout the season.

We recommend that this report be used as a database to monitor trout population responses to changes in management and habitat.

METHODS

Creel Survey

Unstratified creel surveys were conducted during the opening weekends and regular weekends in June of 1984 and 1985 on the Coeur d'Alene River from Dudley upstream to Shoshone Creek and on the North Fork Coeur d'Alene River upstream to Laverne Creek (Figure 1). Number of anglers, residency, hours fished, species harvested and/or released, and total lengths of creeled fish were recorded. Catch rates were calculated by dividing the total catch by the total number of hours. The surveys targeted high-use days to collect baseline information on the fishery and to recover tags from fish tagged during 1984 and the spring of 1985.

A random stratified creel survey was conducted on the Coeur d'Alene River from the confluence of North Fork Coeur d'Alene River downstream to Dudley (Figure 1) between May 24 and June 30, 1986. The survey area was divided into three sections to provide comparative information. The most upstream section (1) was between the North Fork Coeur d'Alene River and the South Fork Coeur d'Alene River. Section 2 was from the South Fork downstream to Interstate 90 bridge, and Section 3 was from the bridge downstream to Dudley.

The survey included two 14-day intervals and one 10-day interval. Six weekend days and six weekdays were randomly selected for the survey. Memorial Day was surveyed and considered an additional weekend day. Three counts, consisting of a four-hour time period per count, were made on each survey day. A count consisted of counting anglers throughout all three sections then conducting angler interviews until the four-hour time period ended. Number of anglers, residency, hours fished, species harvested and/or released, and total lengths of fish were recorded. Anglers who were interviewed during the Coeur d'Alene River stratified creel survey were asked to participate in an opinion survey. Anglers were asked whether they would support or oppose management options to improve cutthroat trout fishing. Specific questions asked were: (1) would you support or oppose a reduction in the bag limit for cutthroat trout?, (2) would you support or oppose the closure of tributaries that are important for cutthroat trout production?, (3) would you support or oppose a minimum size restriction on harvested cutthroat trout?, (4) would you support or oppose a shorter fishing season?, and (5) would you support or oppose a catch-and-release regulation?

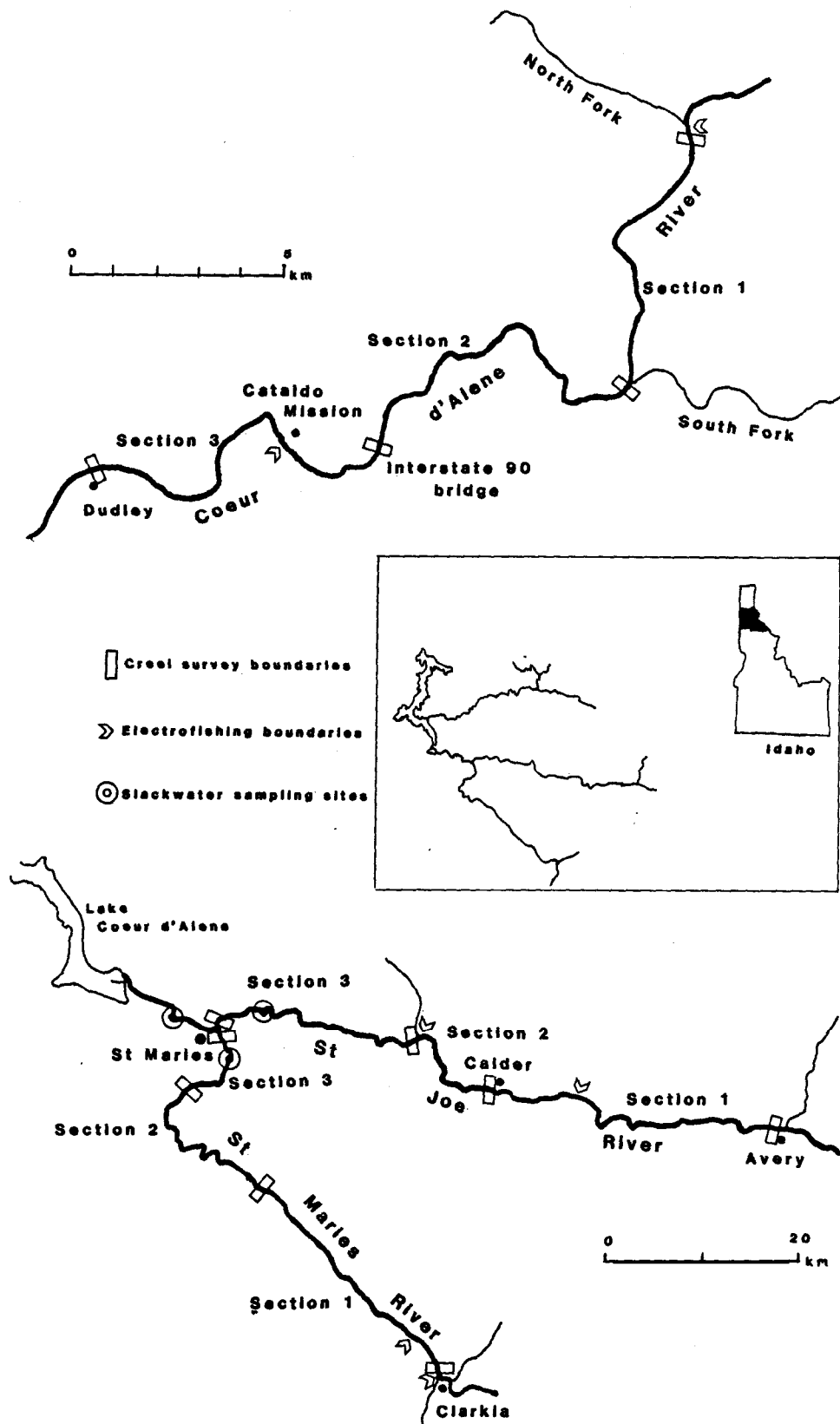


Figure 1. Location of creel survey and fish sampling areas in the Coeur d'Alene, St. Joe, and St. Maries rivers, 1984 through 1987.

A random stratified creel survey was conducted on the St. Joe River from Avery downstream to the town of St. Maries (Figure 1) and on the St. Maries River from the Merry Creek confluence downstream to St. Maries (Figure 1) between May 23 and June 26, 1987. Both rivers were divided into three sections to provide information comparable with past data. The most upstream section (1) in the St. Joe River was from Avery downstream to Calder. Section 2 was from Calder downstream to Falls Creek, and Section 3 was from Falls Creek downstream to St. Maries. Section 1 in the St. Maries River was from the confluence of Merry Creek downstream to Mashburn. Section 2 was from Mashburn downstream to Lotus crossing, and Section 3 was from Lotus crossing downstream to the St. Joe River.

The survey included two 14-day and one 7-day intervals. Six weekend days and five weekdays were randomly selected for the survey. Two creel clerks conducted the survey, with one clerk per river. A minimum of two counts, four hours per count, were made on each survey day. Limited manpower and extensive travel within the surveyed sections restricted the number of counts that could be made during a survey day. A count consisted of counting anglers throughout all three river sections followed by angler interviews until the four-hour time period ended. Number of anglers, residency, hours fished, species harvested and/or released, and total lengths of fish were recorded.

Methodology outlined by Thurow (1981) for estimating angler effort and harvest by river section and angler type (shore or boat) was used for the random stratified creel surveys, as follows:

$$X \text{ WD (H)} + X_i \text{ WE (H)} = \text{angler effort (hours)} \quad (1)$$

Where,

X = mean number of anglers counted for all weekdays during an interval,
 X_i = mean number of anglers counted for all weekend days during an interval,
 WD = total weekdays per interval,
 WE = total weekend days per interval, and
 (H) = mean daylight hours per interval.

$$\text{Angler effort (h)} \times \text{c/f by interval} = \text{minimum harvest estimate/interval} \quad (2)$$

Where,

c/f = fish/hour.

Fish Distribution, Abundance, and Movement

All game fish captured by selected gear types in the Coeur d'Alene, St. Joe, and St. Maries river drainages, including Lake Coeur d'Alene, were anesthetized with Tricaine Methanesulfonate (MS-222), measured to the nearest millimeter total length, and released. Most cutthroat, natural rainbow, and bull trout Salvelinus confluentus that were captured were tagged to provide information on movement and exploitation. Trout between 100 mm and 250 mm were tagged with Floy FTF-69 fingerling tags, and trout longer than 250 mm were tagged with monel metal or aluminum jaw tags. A proportion of the jaw tags were five dollar reward tags and were used to estimate noncompliance of voluntary tag returns (Rieman 1984). In 1984 and 1985, Floy FTF-69 fingerling tags were sewn through the back near the anterior edge of the dorsal fin; whereas in 1986 and 1987, the tags were sewn through the back near the posterior edge of the dorsal fin. All tagged trout were adipose clipped. Surveyed tributaries are shown in Figures 2, 3, and 4.

Gillnetting

Experimental gill nets were fished overnight in slackwater areas of the St. Maries and St. Joe rivers during 1987 to determine fish use. Gill nets were fished in the lower St. Maries River on May 19, July 22, and August 28, and in the St. Joe River on those dates and on December 11. One floating and one sinking gill net were fished overnight at each location on each date (Figure 1).

Tributary Trapping

Selected tributaries to the lower Coeur d'Alene River were trapped for migrating trout from March 19 through June 3, 1985 (Table 1). Tributaries had to be small enough to be safely waded during spring runoff, accessible by vehicle for transportation of materials, and convenient for daily checks.

Weirs, constructed of galvanized conduit pickets supported by angle iron frames, were used to block migrating trout in most streams. In some streams we used a more portable system, with hardware cloth weir panels similar to those used in British Columbia streams by Conlin and Jutty (1979). Metal t-type fence posts (2 m long) were driven into the substrate downstream from the frames or panels to hold them in position.

Migrating trout passed through a pipe and were captured in either a circular metal box (Mauser 1986) (most commonly used) or a trap box constructed of plywood (65 cm x 76 cm x 61 cm outside diameter). The plywood trap box consisted of two compartments separated by a velocity reduction baffle plate, with two exit holes per compartment covered with 6.4 mm square-mesh hardware cloth. Traps were operated to effectively capture upstream and downstream migrating trout and were checked twice daily by Department personnel.

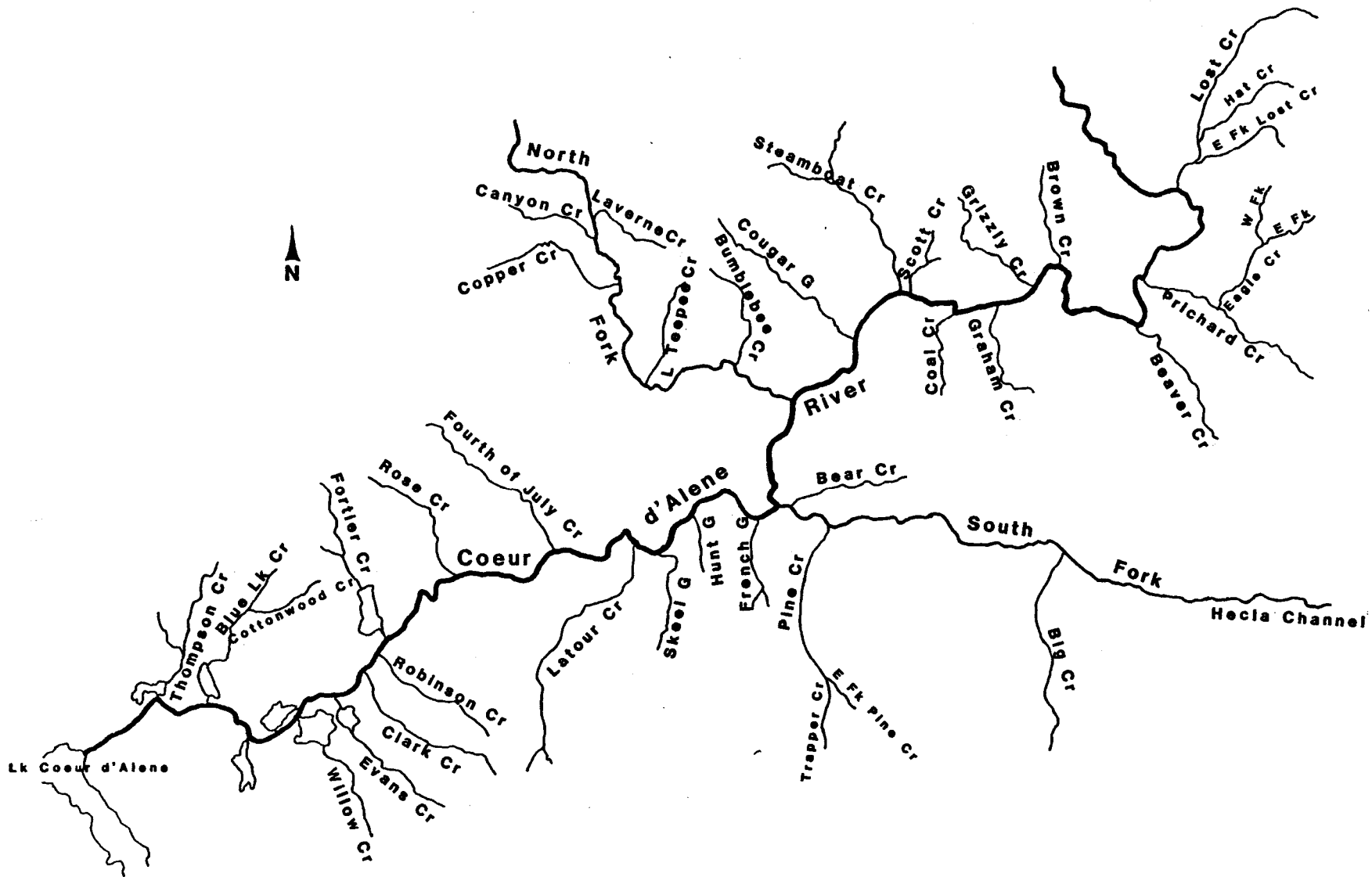


Figure 2. Map of surveyed tributaries to the Coeur d'Alene River, 1984 through 1986.

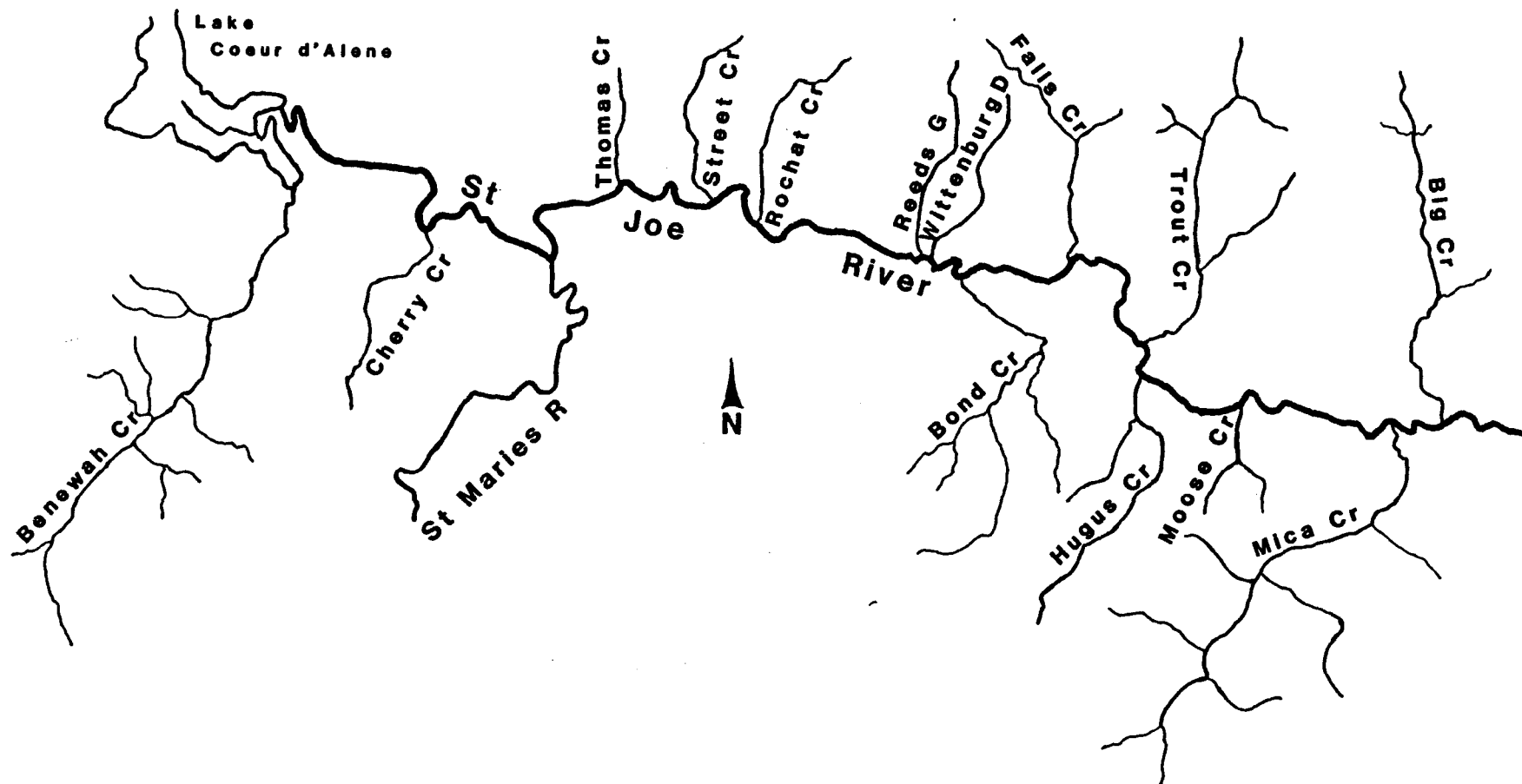


Figure 3. Map of surveyed tributaries to the St. Joe River, 1986 through 1987.

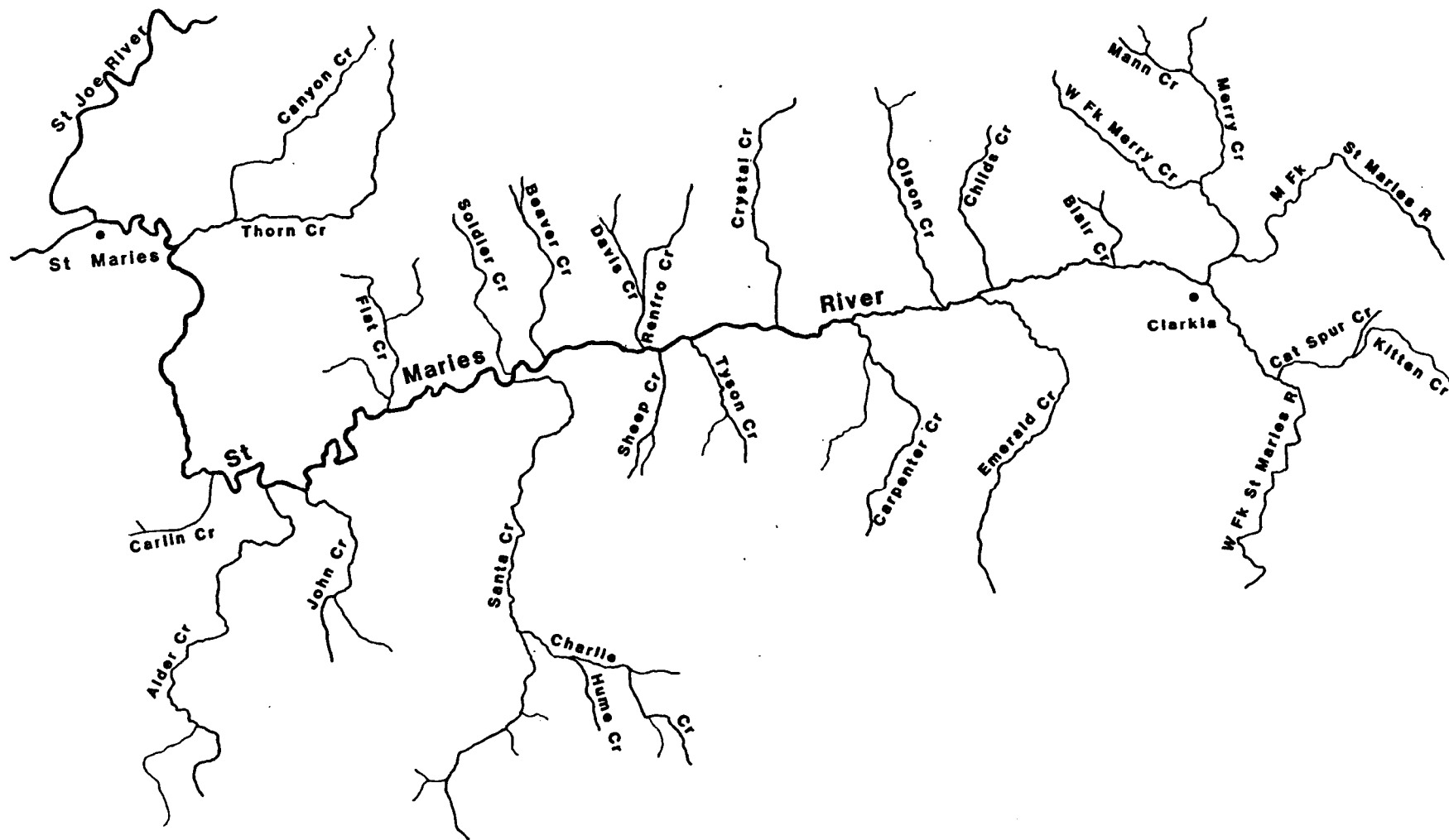


Figure 4. Map of surveyed tributaries to the St. Maries River, 1986 through 1987.

Table 1. Operation of migratory fish traps in tributaries to the Coeur d'Alene River, 1985; to the St. Joe River, 1986; and to the St. Maries River, 1986 and 1987.

Drainage & stream	No. nights operated	Dates trapped
Coeur d'Alene River		
French Gulch	68	March 19-22, 25-31; April 1-April 9-June 3
Hunt Gulch	30	March 26-April 2; April 9-May 1
Cougar Gulch	22	April 1-2; April 26-May 1; May 22-June 3
Brown Creek	29	April 9; April 23-May 20
Skeel Gulch	22	April 23-May 15
Scott Creek	20	May 3-23
St. Joe River		
Benewah Creek	8	April 15, 24, 30; May 7, 13, 20, 28; June 3
Cherry Creek		April 16, 24
Hugus Creek		April 9, 17
Mica Creek	2	April 17, 29
Reeds Gulch	3	April 2, 8, 15
Street Creek	2	April 2, 9
Thomas Creek	2	April 23; May 6
Trout Creek	1	April 29
Whittenburg Draw	2	April 23; May 6
St. Maries River		
Thorn Creek	8	1986 - April 8, 16, 30; May 7, 13, 20, 28; June 3
Merry Creek	8	1987 - April 15, 22; May 4, 13, 20, 27; June 4, 10
Middle Fork	8	1987 - April 15, 22; May 4, 13, 20, 27; June 4, 10
West Fork	7	1987 - April 22; May 4, 13, 20, 27; June 4, 10

Selected tributaries to the St. Joe and St. Maries rivers were trapped in the spring of 1986 and 1987 to evaluate their use by migratory trout (Table 1). Fyke nets, in conjunction with the hardware cloth weir panels used in the Coeur d'Alene River drainage, were used so more streams could be sampled with less effort and greater mobility. Fyke nets were 4 m long reduced to a cod end diameter of 25 cm and connected to a 64 cm x 126 cm rectangle made of 2.5 cm square metal tubing. Nets were attached to 21.5 cm diameter, 2.3 m long ABS sewer pipe with a hose clamp. The pipe was connected to a plywood trap box with the same design used in the Coeur d'Alene River drainage.

Generally, the entire stream channel was fished with the trap operated to capture downstream migrating trout. Traps were fished from late afternoon through the following morning and checked at midnight and just prior to removal.

Electrofishing

Main rivers. A 5.0 m Alumaweld drift boat equipped with a pair of shocking booms, floodlights, a Coffelt variable voltage pulsator (Model VVP-2C, 2,000 watt), a Kawasaki Model 2900 generator, and a live well was used to electrofish the main rivers. The Coeur d'Alene River was electrofished from the confluence of the North Fork Coeur d'Alene River downstream to Cataldo Mission (Figure 1). One night was spent electrofishing from the confluence of the North Fork downstream to the confluence of the South Fork, and five nights were spent electrofishing from the South Fork downstream to Cataldo Mission. The St. Joe River was electrofished from Huckleberry Campground downstream to Falls Creek (Figure 1). Two nights were spent electrofishing from Huckleberry Campground to Moose Creek, and two nights were spent electrofishing from Moose Creek to Falls Creek. Two days were spent electrofishing the St. Maries River from Clarkia downstream to the Metropolitan Bridge (Figure 1). The river's relatively small size and overhanging vegetation required this section to be electrofished during the day.

Tributaries. A Smith-Root Model 11A battery-powered backpack unit was used to electrofish tributaries. Several reaches of each tributary were electrofished, when possible, to provide adequate representation of species composition, sizes, and length frequencies. We subjectively chose electrofishing sites, attempting to find the highest densities of fish. An effort was made to tag 50 cutthroat trout per tributary to provide movement information.

Slackwater. Three stations in the St. Joe River and one in the St. Maries River were sampled using a 4.3 m electrofishing boat equipped similar to the drift boat (Figure 1). Stations coincided with gillnetting locations, and sampling was done during the latter portions of June, July, and August.

Snorkeling

Estimates of relative salmonid abundance were made in the Coeur d'Alene, St. Joe, and St. Maries river tributaries using underwater observation techniques similar to those described by Rankel (1971), Thurow (1976), Johnson (1977), and Pratt (1984). Pool-riffle-run complexes were snorkeled when available, but at least one pool and a riffle or run were snorkeled per transect. Transects were a minimum of 30 m long. Stream widths were measured in several locations of the transect, averaged, and then multiplied by transect length to calculate total surface area. Snorkeling transects were representative of the stream habitat in the area. Fish densities were calculated and expressed as fish/100 m². Snorkeling was conducted in late summer and early fall at low stream discharge when minimal movement of cutthroat trout occurs (Rankel 1971).

Lake Merwin Trap

A Lake Merwin trap was fished in the Coeur d'Alene River channel immediately north of Harrison between June 24 and July 17, 1984 and under the Bull Run Lake Bridge (32 km upstream from the confluence with Lake Coeur d'Alene) from March 28 through July 31, 1985. In 1984, the trap was installed facing upstream to catch downstream migrating fish. In 1985, the trap was faced downstream to capture upstream migrating fish. The trap was fished for seven consecutive days from March 28 until water levels rose nearly 3 m and increased velocity and associated debris made it impossible to operate the trap. The trap was repositioned on July 9 facing upstream and fished through July 31.

The trap was originally designed to fish lakes and was adapted to fish the river for capturing adfluvial cutthroat trout (Horton 1985). The trap was modified by hanging weights from the corners of the pot and heart to hold the sidewalls in place against the current. One 30 m lead was used to direct fish into the trap with extensions attached to the wings. During both years, only part of the river channel was fished to allow passage of boat traffic.

Purse Seining

Lake Coeur d'Alene was sampled with purse seine gear from November 4 to November 7, 1986 in an attempt to recapture cutthroat trout tagged in the Coeur d'Alene, St. Joe, and St. Maries river drainages and to tag cutthroat trout in the lake. Locations were randomly selected throughout the lake, but most sampling was conducted in the south end.

Cutthroat Trout Growth

Growth was analyzed for cutthroat trout from the Coeur d'Alene River, Benewah Creek (St. Joe River tributary), and Thorn Creek (St. Maries River tributary). The latter two samples were combined due to similarities in growth rates.

Scales were collected from cutthroat trout above the lateral line directly below the adipose fin (Brown and Bailey 1952). Several scales from each fish were impressed on an acetate sheet using a hydraulic laboratory press at approximately 20,000 lbs/in². Scale radius to annuli formation and total anterior scale radius of the magnified impressions were measured (mm) at an angle of 30° from anterior following Pratt (1984). Scales were read by two individuals to check for consistency in age and measurements.

The Fraser-Lee method of back-calculating cutthroat trout length-at-age was used due to the strong linear body-scale relationship (Everhart and Youngs 1981). The formula used was:

$$L_t = C + S_t/S (L - C) \quad (3)$$

Where,

- L_t = the calculated length of a fish at age t ,
- L = length of the fish at time of capture,
- S = scale radius at time of capture,
- S_t = scale radius at annulus, and
- C = correction factor (the y-intercept from the linear regression of fish length on scale radius or determined empirically as length-at-squamation).

The value of the y-intercept (55 mm) from the body length-scale radius linear regression of cutthroat trout from the Coeur d'Alene River was used (Appendix A). Lewynsky (1986) empirically determined that 55 mm was length-at-squamation of cutthroat trout from the Coeur d'Alene River. Because of the small number of large cutthroat trout in the Benewah and Thorn creeks sample, the calculated y-intercept (14 mm) was not used. Instead, the value of 45 mm, determined empirically as length-at-squamation for St. Joe River cutthroat trout, was used (Rankel 1971) (Appendix B).

Age frequencies of cutthroat trout. Back-calculated length-at-age of cutthroat trout were used to create an age-length frequency key for each the Coeur d'Alene River sample and the Benewah and Thorn creeks sample (Ricker 1975). Age-length frequency keys were used to convert cutthroat trout length frequencies to age frequencies in order to develop catch curves to estimate survival and mortality for other streams within the respective drainages (Ricker 1975; Everhart and Youngs 1981).

RESULTS

Harvest and Exploitation

Coeur d'Alene River: Unstratified Creel Survey

Unstratified creel surveys 'showed cutthroat trout represented 57% (1984) and 53% (1985) of the total catch from Dudley to Shoshone Creek, which included the North Fork upstream to Laverne Creek. Rainbow trout comprised 401 and 411 of the catch in 1984 and 1985, respectively. Brook Salvelinus fontinalis, bull, and cutthroat-rainbow hybrid trout represented less than 51 of the total catch.

Partitioning the river into sections showed a considerable difference in species composition. Cutthroat trout represented 911 (1984) and 73% (1985) of the total catch from Dudley to the South Fork and only 451 (1984) and 23% (1985) from the South Fork to Shoshone Creek. Rainbow trout dominated the catch at 521 (1984) and 611' (1985) from the South Fork to Shoshone Creek. From Dudley to the South Fork, rainbow trout were caught in relatively low numbers and represented 51 (1984) and 201 (1985) of the total catch. The North Fork catch was dominated by rainbow trout at 68% (1984) and 77% (1985) followed by cutthroat trout at 28% (1984) and 20% (1985).

Catch rates of cutthroat trout ranged from 0.06 fish/h (1984) and 0.17 fish/h (1985) in the North Fork to 0.20/h (1984) and 0.47 fish/h (1985) between Dudley and the South Fork. Overall trout catch rates for the entire section surveyed were 0.27 trout/h (1984) and 0.53 trout/h (1985).

Coeur d'Alene River: Stratified Creel Survey

Angler effort estimated for all sections during the survey was 10,662 h (Table 2). Section 3 (Figure 1) received the most angling effort followed by sections 1 and 2, respectively. Boat angling in Section 3 accounted for 77% of total boat effort. Distribution of shore effort was relatively even among sections. Interval 1 received the most angling effort (56%), which progressively decreased in all sections during intervals 2 and 3. The most dramatic change occurred in Section 3 where 68% of the total boat effort occurred during Interval 1 and decreased twofold each remaining interval.

Total harvest estimated for cutthroat trout was 1,767 fish, of which 1,131 (64%) were harvested in Section 3 (Table 2). Of those cutthroat trout harvested in Section 3, 924 (81%) were caught by boat anglers. The majority (821) of the cutthroat trout harvest in Section 3 occurred during Interval 1 (Appendix C). Hatchery and natural rainbow trout caught in Section 1 accounted for 83% of the total rainbow harvest for all sections.

Table 2. Estimated effort (h), harvest (number of fish), and catch rates (fish/h) by river section and interval for boat and shore anglers from the Coeur d'Alene River creel survey, May 24 through June 30, 1986.

		Effort									
		Section 1			Section 2			Section 3			
Date	Interval	Boat	Shore	Combined	Boat	Shore	Combined	Boat	Shore	Combined	Total
5/24-6/06	1	241	1,390	1,631	98	969	1,067	1,782	1,510	3,292	5,990
6/07-6/20	2	111	1,060	1,171	142	648	790	772	678	1,450	3,411
6/21-6/30	3	149	310	459	43	331	374	54	374	428	1,261
Total		501	2,760	3,261	283	1,948	2,231	2,608	2,562	5,170	10,662

		Harvest							Total
		Cutthroat trout	CTT-RBT hybrid trout	Natural rainbow trout	Hatchery rainbow trout	Brook trout	Kokanee salmon	Bull trout	
Section 1	boat	53	5	10	51	0	0	0	119
	shore	283	28	48	306	0	0	0	665
Section 2	boat	18	10	0	0	9	78	0	115
	shore	282	55	0	0	26	202	0	565
Section 3	boat	924	18	11	11	18	214	0	1,196
	shore	207	15	32	32	15	251	0	552
Total	boat	995	33	21	62	27	292	0	1,430
	shore	772	98	80	338	41	453	0	1,782

Time period		Catch rate (harvest rate)							
		5/24-6/06 Interval 1		6/07-6/20 Interval 2		6/21-6/30 Interval 3		Total of intervals	
Section 1	trout ^a	0.43	(0.27)	0.23	(0.18)	0.30	(0.25)	0.34	(0.23)
	cutthroat	0.26	(0.14)	0.10	(0.07)	0.15	(0.10)	0.18	(0.11)
Section 2	trout	0.22	(0.12)	0.29	(0.27)	0.13	(0.09)	0.23	(0.17)
	cutthroat	0.22	(0.12)	0.26	(0.24)	0.04	(0.04)	0.21	(0.15)
Section 3	trout	0.36	(0.33)	0.12	(0.12)	0.17	(0.17)	0.29	(0.25)
	cutthroat	0.35	(0.32)	0.12	(0.12)	0.06	(0.06)	0.28	(0.27)
Total of sections	trout	0.35	(0.29)	0.19	(0.17)	0.20	(0.17)	0.29	(0.24)
	cutthroat	0.32	(0.25)	0.14	(0.13)	0.08	(0.07)	0.25	(0.20)

^aTrout includes cutthroat, cutthroat-rainbow hybrid, rainbow, brook, and bull trout.

Hybrids of cutthroat and rainbow trout were caught in all three sections in relatively low numbers. Kokanee salmon Oncorhynchus nerka was the second most abundant species harvested in sections 2 and 3. Brook trout were caught in sections 2 and 3 and represented a small portion of the total harvest. Bullhead Ictalurus sp. and yellow perch Perca flavescens were caught within the slackwater portion of Section 3, but estimates were not calculated because they were a minor part of the total harvest. No bull trout were harvested during the survey. Total trout harvest during the survey was 2,467 trout.

Cutthroat trout harvest rates were highest in Section 3, followed by sections 2 and 1, respectively (Table 2). Section 3 harvest rates decreased dramatically during the survey. Harvest rates for cutthroat trout in Section 1 decreased slightly during the survey, but trout harvest rates remained relatively constant. Section 2 harvest rates increased during Interval 2, but plummeted during Interval 3. A comparison of catch rates versus harvest rates showed most trout caught in Section 3 were harvested; conversely, 60% of the trout caught in Section 1 were released.

Harvested cutthroat trout ranged from 160 mm to 400 mm, with a mean length of 317 mm (Figure 5). Of the cutthroat trout harvested, 22% were larger than 350 mm. The two largest fish measured during the survey were a 465 mm brook trout and a 446 mm cutthroat-rainbow hybrid trout. Relative species abundance in the overall harvest for all sections was: 55% cutthroat trout, 15% rainbow trout, 4% cutthroat-rainbow hybrid trout, 2% brook trout, and 23% kokanee salmon.

St. Joe River: Stratified Creel Survey

Estimated angler effort for all sections of the St. Joe River during the survey was 7,511 h. Section 1 (Figure 1) received the most angling effort followed by sections 3 and 2, respectively (Table 3). Although considerably shorter than the other river sections, Section 2 supported angler effort comparable to Section 3. Shore effort in Section 3 increased during the survey. Boat angler effort represented a small portion (9%) of the total effort in sections 1 and 2; therefore, boat and shore angler estimates were combined.

Total harvest estimated for cutthroat trout for all river sections was 1,673 fish, of which 1,311 (78%) were harvested during Interval 1 (Table 3; Appendix D). Distribution of cutthroat trout harvest was relatively even among river sections. In Section 3, 42% of the cutthroat trout harvest occurred in the slackwater portion. Cutthroat-rainbow trout hybrids were harvested in sections 1 and 2 in relatively low numbers. Rainbow trout were harvested in all sections with 80% of the harvest occurring in Section 1. Bull trout were harvested in all three river sections. Bullhead, yellow perch, and pumpkinseeds Lepomis gibbosus were harvested in the slackwater portion of Section 3 in small numbers. For the duration of the survey, total estimated trout harvest for all sections was 2,496 fish.

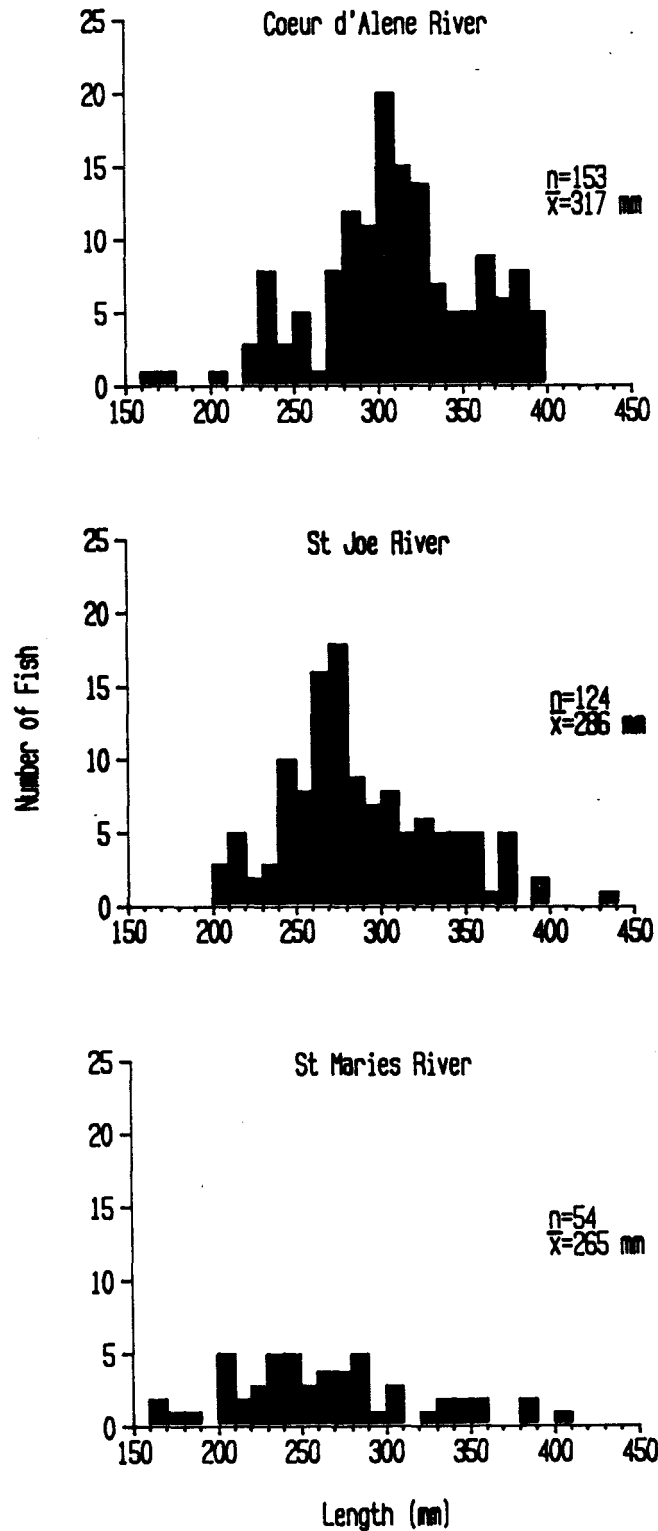


Figure 5. Length frequencies of cutthroat trout harvested by anglers from the lower Coeur d'Alene River (1986), the lower St. Joe River (1987), and the St. Maries River (1987).

Table 3. Estimated effort (h), harvest (number of fish), and catch rates (fish/h) by river section and interval for boat and shore anglers during the St. Joe River creel survey, May 23 through June 26, 1987.

		Effort									
Date	Interval	Section 1			Section 2			Section 3			Total
		Boat ^a	Shore	Combined	Boat ^a	Shore	Combined	Boat	Shore	Combined	
5/23-6/05	1	--	1,684	1,684	--	1,178	1,178	567	332	899	3,761
6/06-6/19	2	--	1,280	1,280	--	363	363	179	424	603	2,246
6/20-6/26	3	--	504	504		232	232	32	736	768	1,504
Total		--	3,468	3,468	--	1,773	1,773	778	1,492	2,270	7,511
		Harvest									
		Cutthroat trout	CTT-RBT hybrid trout	Natural rainbow trout	Hatchery rainbow trout	Brook trout	Kokanee salmon	Bull trout	Total		
Section 1 ^a	boat ^a	--	--	--	--	--	--	--	--	--	
	shore	677	77	171	344	11	11	28	1,319		
Section 2 ^a	boat ^a	--	--	--	--	--	--	--	--	--	
	shore	445	35	61	44	0	5	13	603		
Section 3	boat	240	0	0	0	0	19	19	278		
	shore	311	0	0	20	0	0	0	331		
Total	boat	240	0	0	0	0	19	19	278		
	shore	1,433	112	232	408	11	16	41	2,253		
		Catch rate (harvest rate)									
Time period		5/23-6/05 Interval 1		6/06-6/19 Interval 2		6/20-6/26 Interval 3		Total of intervals			
Section 1	trout ^b	0.57	(0.44)		0.29		0.38	0.44	(0.38)		
	cutthroat	0.36	(0.28)		0.13 (0.09)		0.17 (0.17)	0.25	{0.19}		
Section 2	trout	0.49	(0.47)		0.10 (0.06)		0.13 (0.11)	0.35	(0.32)		
	cutthroat	0.36	(0.34)		0.09 (0.04)		0.13 (0.13)	0.27	(0.24)		
Section 3	trout	0.77	(0.54)		0.10 (0.10)		0.08 (0.08)	0.31	(0.23)		
	cutthroat	0.74	(0.51)		0.08 (0.08)		0.08 (0.08)	0.29	(0.22)		
Total of sections	trout	0.56	(0.48)		0.20 (0.17)		0.20 (0.12)	0.39	(0.33)		
	cutthroat	0.40	(0.33)		0.11 (0.07)		0.12 (0.12)	0.26	(0.21)		

^aBoat and shore data combined.

^bTrout includes cutthroat, cutthroat-rainbow hybrid, rainbow, brook, and bull trout.

Harvest rates for cutthroat trout were similar among river sections (Table 3). Harvest rates declined in all river sections after Interval 1, except for the consistent harvest of stocked rainbow trout in Section 1. During Interval 1, catch rates were noticeably higher than harvest rates, whereas catch and harvest rates were almost the same during intervals 2 and 3. Weekly catch rates of cutthroat trout decreased and catch rates of northern squawfish increased as the season progressed (Figure 6).

Harvested cutthroat trout ranged from 200 mm to 430 mm, with a mean length of 286 mm (Figure 5). Of the cutthroat trout harvested, 11% were longer than 350 mm. The largest fish measured during the survey was a 720 mm bull trout. Relative species abundance of the harvest for all sections was: 66% cutthroat trout, 25% rainbow trout, 4% cutthroat-rainbow hybrid trout, 0.4% brook trout, 21 bull trout, and 1% kokanee salmon.

St. Maries River: Stratified Creel Survey

Angler effort estimated for all sections during the survey was 2,599 h (Table 4). Section 1 (Figure 1) received 741 of the total angler effort. Sections 1 and 2 received the most angler effort during Interval 2. Boat anglers represented a small portion (<1%) of the total anglers in sections 1 and 2 and therefore were combined with shore angler effort.

Section 1 accounted for 921 of the total trout harvest (Table 4). Cutthroat trout comprised 221 and rainbow trout 77% of the total harvest in Section 1. Cutthroat trout were only harvested during intervals 1 and 2 (Appendix E). Cutthroat-rainbow trout hybrids were harvested in sections 1 and 2 in relatively low numbers. Bull trout were only harvested in Section 1. Bullhead was the most abundant game species caught in Section 3, followed by pumpkinseeds, yellow perch, cutthroat trout, and largemouth bass Micropterus salmoides. Total trout harvest for all sections during the survey was 1,633 trout.

Trout harvest rate was highest in Section 1 followed by sections 2 and 3, respectively (Table 4). Cutthroat trout harvest rates declined to zero in all sections by the end of the survey. A comparison of catch rates versus harvest rates showed that over 30% of the trout caught in sections 1 and 2 **were** released. Trout catch rate in Section 1 remained above 1.0 fish/h throughout the survey.

Harvested cutthroat trout ranged from 160 mm to 400 mm, with a mean length of 265 mm (Figure 5). Of those cutthroat trout harvested, 9% were longer than 350 mm. Relative species abundance in the harvest for all sections was: 27% cutthroat trout, 71% rainbow trout, 1% cutthroat-rainbow hybrid trout, and 1% bull trout. Weekly catch rates for northern squawfish and cutthroat trout paralleled each other throughout the survey (Figure 6).

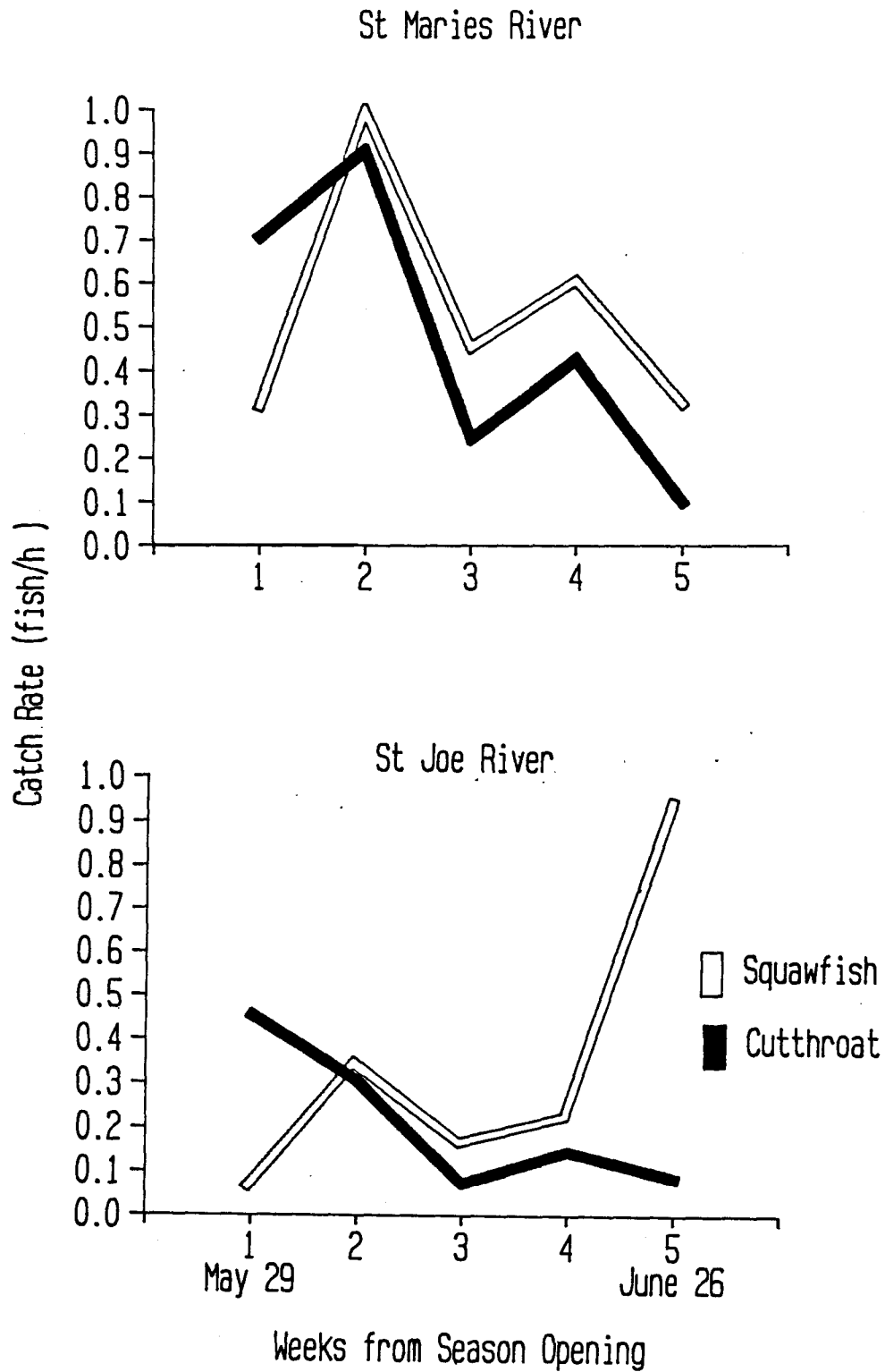


Figure 6. Weekly angler catch rates of northern squawfish and cutthroat in the St. Joe and St. Maries rivers, 1987.

Table 4. Estimated effort (h), harvest (number of fish), and catch rates (fish/h) by river section and interval for boat and shore anglers during the St. Maries River creel survey, May 23 through June 26, 1987.

		Effort									
Date	Interval	Section 1			Section 2			Section 3			Total
		Boat	Shore	Combined	Boat	Shore	Combined	Boat		Shore	
5/23-6/05	1	--	600	600	--	112	112	16	131	147	859
6/06-6/19	2	--	976	976	--	154	154	32	90	122	1,252
6/20-6/26	3	--	360	360	--	32	32	0	96	96	488
Total		--	1,936	1,936	--	298	298	48	317	365	2,599
		Harvest									
		Cutthroat	CTT-RBT	Natural	Hatchery	Brook	Kokanee	Bull	Total		
		trout	hybrid	rainbow	rainbow	trout	salmon	trout			
•Section 1 ^a	boat	--	--	--	--	--	--	--	--	--	
	shore	327	12	12	1,146	0	0	12	1.5		
•Section 2 ^a	boat	--	--	--	--	--	--	--	--	--	
	shore	98	2	0	2	0	0	0	102		
•Section 3	boat	0	0	0	0	0	0	0	0	0	
	shore	22	0	0	0	0	0	0	22		
Total	boat	0	0	0	0	0	0	0	0	0	
	shore	447	14	12	1,148	0	0	12	1,633		
		Catch rate (harvest rate)									
Time period		5/23-6/05		6/06-6/19		6/20-6/26		Total of			
		Interval 1		Interval 2		Interval 3		intervals			
Section 1	trout ^b	1.16	(0.64)	1.12	(0.79)	1.07	(0.98)	1.13	(0.78)		
	cutthroat	0.76	(0.30)	0.26	(0.15)	0.03	(0)	0.35	(0.16)		
Section 2	trout	0.91	(0.74)	0.71	(0.13)	0.33	(0)	0.81	(0.54)		
	cutthroat	0.88	(0.70)	0.58	(0.13)	0.33	(0)	0.76	(0.52)		
Section 3	trout	0.17	(0.17)	0	(0)	0	(0)	0.08	(0.08)		
	cutthroat	0.17	(0.17)	0	(0)	0	(0)	0.08	(0.08)		
Total of sections	trout	0.89	(0.61)	1.02	(0.68)	0.77	(0.60)	0.92	(0.63)		
	cutthroat	0.72	(0.46)	0.28	(0.14)	0.08	(0)	0.42	(0.24)		

^aBoat and shore data combined.

^bTrout includes cutthroat, cutthroat-rainbow hybrid, rainbow, brook, and bull trout.

Coeur d'Alene River: Angler Opinion Survey

Ninety-eight percent of the anglers interviewed supported the implementation of a drainagewide management program to improve cutthroat trout fishing. Five different restrictive regulations were developed and presented to anglers willing to participate in the questionnaire (Figure 7). Most anglers favored reducing the bag limit for cutthroat trout. Most anglers favored closing some tributaries important for cutthroat trout spawning and rearing. Anglers generally opposed a shortened fishing season for cutthroat trout or drainagewide catch-and-release regulations. Anglers were, evenly split over the implementation of a minimum size restriction for cutthroat trout. The majority of the anglers interviewed were local residents.

Exploitation

Voluntary tag return noncompliance was estimated to be 72% for the Coeur d'Alene River drainage, 31% for the St. Joe River drainage, and 78% for the St. Maries River drainage.

Trout were tagged in the Coeur d'Alene River during 1985 and 1986. Four cutthroat trout were tagged in 1984, but none of those have been recovered. Estimated exploitation of all trout was 26% in 1985 and 19% in 1986. Cutthroat trout exploitation was 29% in 1985 and 33% in 1986. Few tags from the St. Joe River were returned each year of the study. Trout were tagged in the St. Maries River and tributaries during 1986 and 1987, but returns were reported in 1987 only. Accurate exploitation estimates for populations in both rivers were unreliable because of unknown natural mortality and the bias of migration. Also, trout were tagged prior to and during the fishing season, violating the assumption that all tagged fish are equally vulnerable to angling. Exploitation was probably between 25 and 50% in the St. Joe River and higher than 50% in the St. Maries River.

Fish Distribution and Abundance

Main River Sampling

Coeur d'Alene River electrofishing. Mountain whitefish Prosopium williamsoni was the dominant game fish captured in the electrofishing sample from the Coeur d'Alene River in 1986. Kokanee salmon was the next most abundant salmonid caught, appearing in both electrofished sections of the river from June through October (Figure 1; Appendix F). Cutthroat trout were the most abundant of all trout sampled, followed by brook trout, rainbow trout, and cutthroat-rainbow trout hybrids. Cutthroat trout, rainbow trout, cutthroat-rainbow trout hybrids, and mountain whitefish were caught in both sections of the river on all sampling dates. Brook trout were not found in the river between the North Fork and the South Fork.

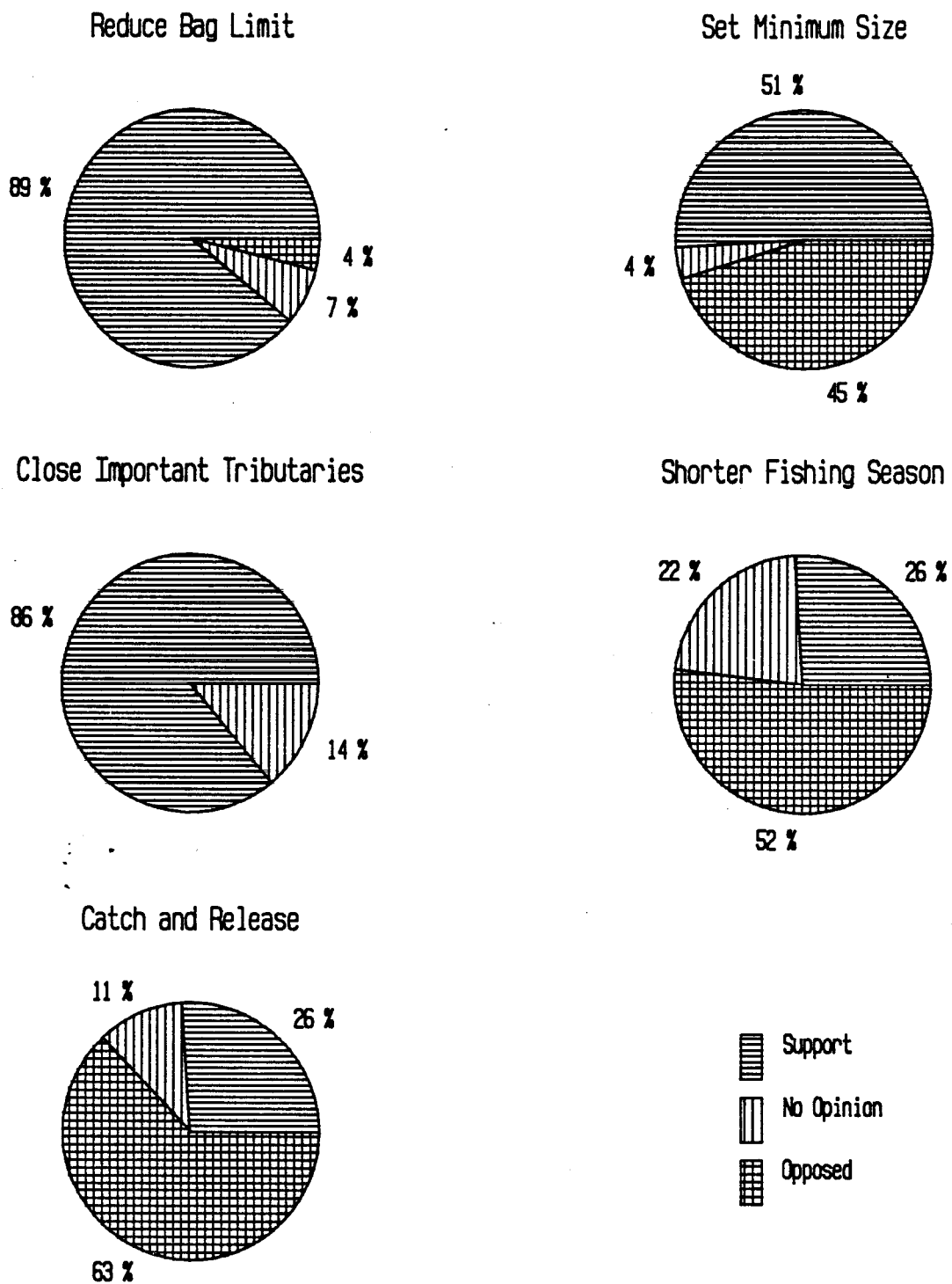


Figure 7. Support of management options by anglers interviewed during the Coeur d'Alene River creel survey, 1986.

Cutthroat trout were evenly distributed in length, ranging from 100 to 469 mm with a mean length of 273 mm (Figure 8). Twenty-four percent of cutthroat trout sampled were larger than 350 mm. Annual mortality of 58% was estimated for cutthroat trout ages III, IV, and V from a electrofishing catch curve. Lengths of rainbow trout ranged from 100 to 529 mm, with a mean length of 262 mm. Brook trout and cutthroat-rainbow trout hybrids were generally smaller, with mean lengths of 205 and 211 mm, respectively.

Lake Merwin trapping. Bullhead and tench Tinca tinca dominated the Lake Merwin trap catch in 1984 and 1985 in the lower Coeur d'Alene River (Appendix G). Pumpkinseeds, kokanee salmon, northern squawfish, yellow perch, black crappie Pomoxis nigromaculatus, suckers Catostomus sp., largemouth bass, redbreast shiners Richardsonius balteatus, and northern pike Esox lucius were caught in smaller numbers.

St. Joe River electrofishing. Mountain whitefish was the dominant game fish captured in the electrofishing sample from the St. Joe River in 1986 and was caught in both river sections on all sampling dates (Appendix F). No cutthroat trout and only three rainbow trout were caught during August sampling when water temperatures exceeded 20°C in both sections (Figure 1). Cutthroat trout and rainbow trout were caught in both sections in October. Two adult bull trout were also caught in the lower section in October. Lengths of cutthroat trout ranged from 223 to 385 mm, with a mean length of 308 mm (Figure 8). The catch of cutthroat trout was not sufficient to estimate annual mortality. Lengths of rainbow trout ranged from 213 to 429 mm, with a mean length of 319 mm.

St. Maries River electrofishing. Mountain whitefish was the dominant game fish captured in the electrofishing samples from the St. Maries River in 1987. Other salmonids captured were cutthroat trout, rainbow trout, and cutthroat-rainbow trout hybrids. Cutthroat trout lengths ranged from 137 to 345 mm, with a mean length of 230 mm (Figure 8; Appendix F). Annual mortality of 502 was estimated for cutthroat trout ages II, III, and IV from a catch curve. Rainbow trout lengths ranged from 147 to 270 mm, with a mean length of 218 mm. Lengths of cutthroat-rainbow trout hybrids ranged from 106 to 198 mm, with a mean length of 166 mm.

Suckers dominated electrofishing samples from all the rivers on all sampling dates.

Slackwater Sampling

Gillnetting. No trout were collected with gill nets from the slackwater reaches of the St. Joe and St. Maries rivers. Suckers, northern squawfish, and bullheads were the dominant species collected and comprised 362, 302, and 252, respectively, of the total sample (Figure 9; Appendix H). No bullheads, however, were collected in the December sample. Mountain whitefish, yellow perch, largemouth bass, black crappie, pumpkinseeds, tench, and sculpins Cottus sp. were collected in small numbers from both rivers.

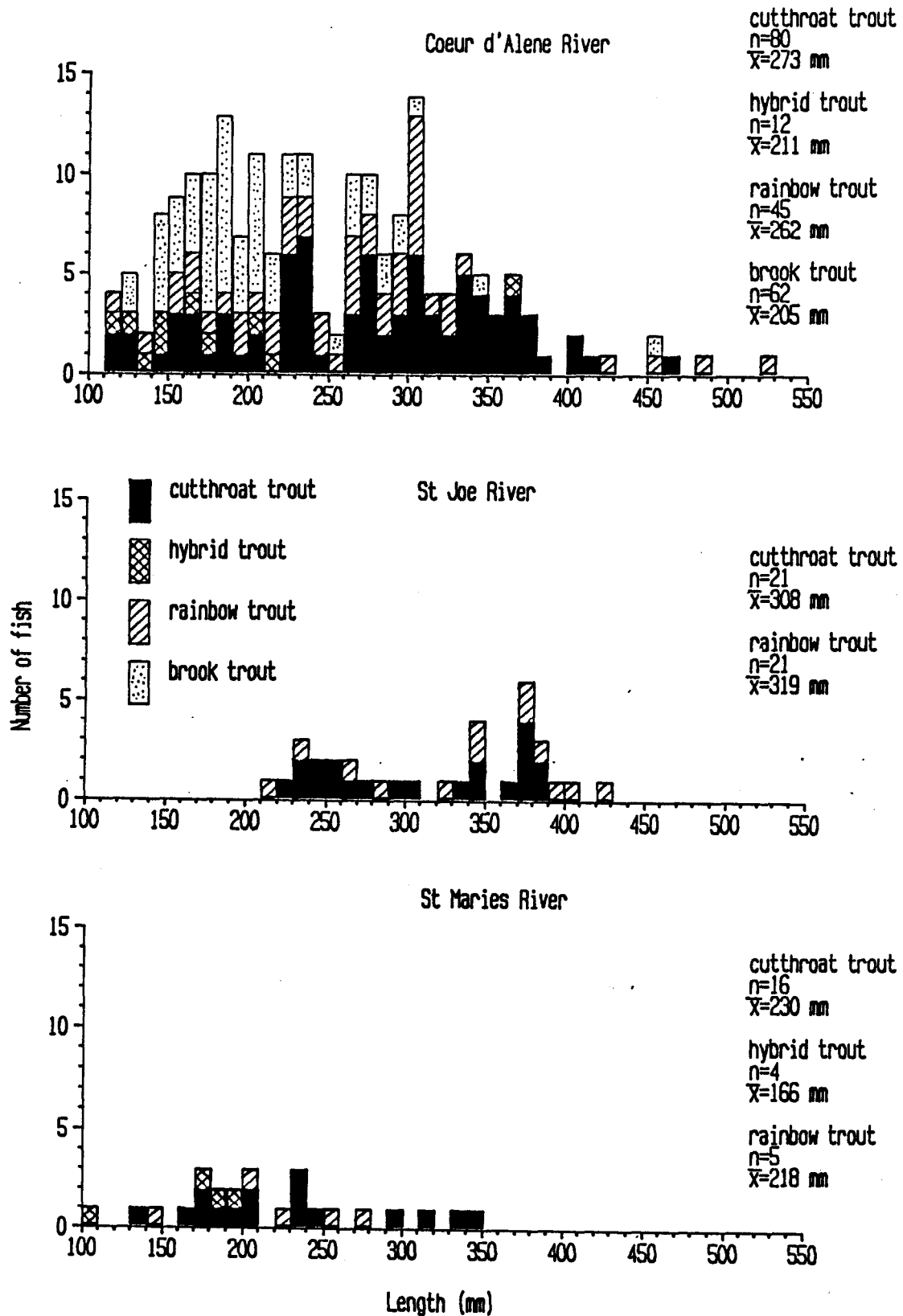
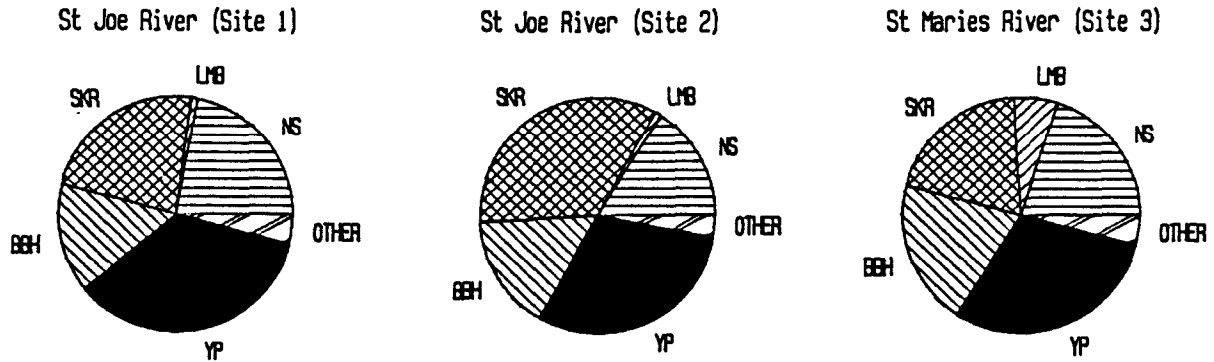
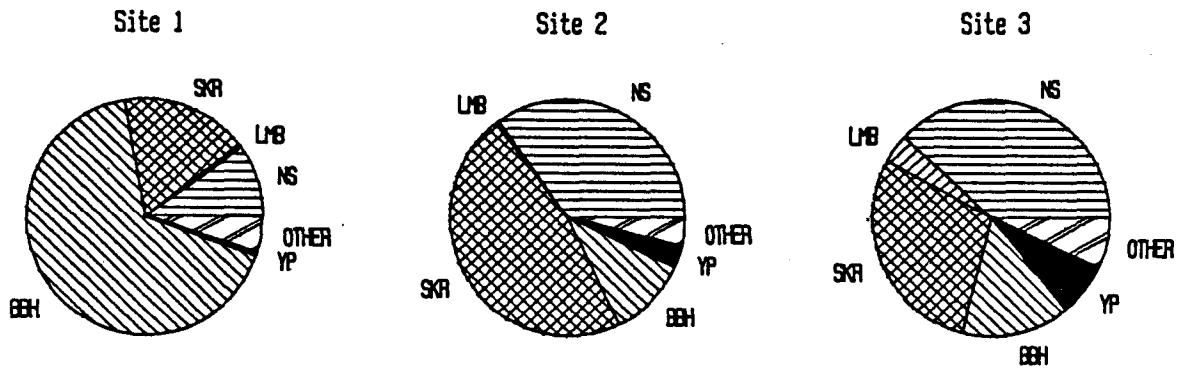


Figure 8. Length frequencies of trout sampled from the lower Coeur d'Alene, lower St. Joe, and St. Maries rivers with electrofishing gear, 1986 through 1987.

Electrofishing (Summer)



Gillnetting (Summer)



Gillnetting (Winter)

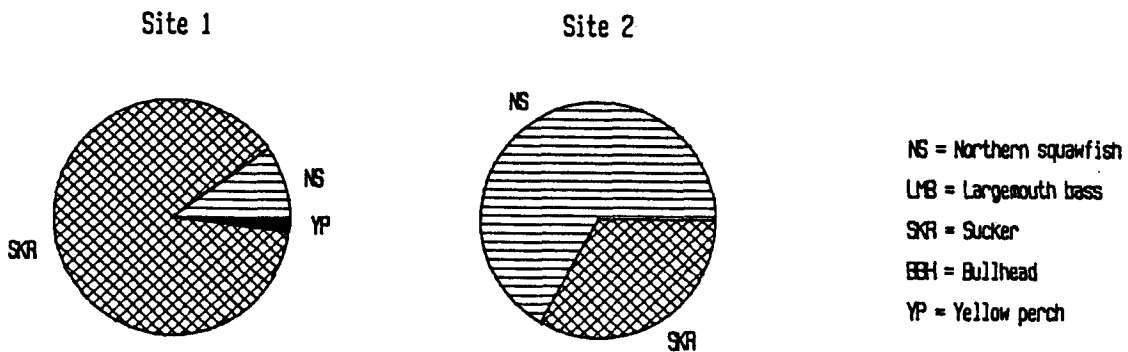


Figure 9. Relative species abundance in slackwater reaches of the St. Joe and St. Maries rivers, as determined from gill net and electrofishing samples, 1987.

Electrofishing. Slackwater reaches of the St. Joe and St. Maries rivers were electrofished on three occasions during the summer of 1987. Suckers, northern squawfish, yellow perch, and bullheads comprised 26%, 21%, 31%, and 16%, respectively, of the total number of fish collected (Figure 9; Appendix I). Relative abundance of each species was similar for each location over all sampling dates. Species composition was the same as determined by gillnetting, with the exception of a few redbreasted shiners collected only with electrofishing gear.

Tributary Electrofishing

Table 5 shows the fish species present in tributaries to the three rivers studied. Relative abundances and length distributions of trout and char species found in the tributaries appear in Appendix J. Catch data from electrofishing efforts appear in Appendix K. Cutthroat trout were present in all surveyed tributaries to the Coeur d'Alene River except Little Tepee Creek, which had only brook trout. Fish communities in tributaries were dominated by either cutthroat or brook trout. Rainbow trout and cutthroat-rainbow trout hybrids comprised less than 25% of the salmonids in any given tributary. Small numbers of bull trout were found in Brown and Graham creeks.

Length frequencies of cutthroat trout were summarized for 31 tributaries to the Coeur d'Alene River (Figure 10). The majority of cutthroat trout found in these tributaries during summer electrofishing sampling were age I and II.

Cutthroat trout comprised 74% and rainbow trout comprised 20% of trout and char species in Hecla Channel on the South Fork Coeur d'Alene River (Figure 10; Appendix J). Brook trout, kokanee salmon, and chinook salmon *Oncorhynchus tshawytscha* were found in small numbers. Cutthroat trout were generally larger in Hecla Channel than in the tributaries.

St. Joe River tributaries were dominated by cutthroat and brook trout. Rainbow trout were found only in Mica and Trout creeks and then only at low abundance (1%) relative to other species. Low numbers of cutthroat-rainbow trout hybrids, however, were identified in five of the 12 streams surveyed. Bull trout were found in Mica, Thomas, Trout, and Cherry creeks.

Length frequencies of cutthroat trout in tributaries to the St. Joe River were summarized in two groups based on fishing regulations. Bond, Mica, Rochat, and Trout creeks have been closed to fishing since 1973; while Benewah, Cherry, Hugus, Moose, Street, and Thomas creeks were managed with general fishing regulations prior to and throughout this project. The mean length of cutthroat trout was 29 mm longer and the length distribution wider in the tributaries closed to fishing (Figure 11; Appendix J). A small proportion of age III cutthroat trout (<1%) and no age IV cutthroat trout were found in the tributaries with general fishing regulations. In the closed tributaries, 5% of cutthroat trout were age III and 1% were age IV. Proportions of age I and II cutthroat trout were similar between

Table 5. Fish species present (+) in tributaries to the Coeur d'Alene, St. Joe, and St. Maries rivers, 1984-1987. Species presence is representative of locations sampled throughout the tributary.

		Species present				
Cutthroat		Rainbow	Hybrid	Brook	Bull	Other
Stream	trout	trout	RBT-CTT	trout	trout	species
Coeur d'Alene River						
Bear Cr.	+	+		+		
Blue Lake Cr.	+			+		
Cottonwood Cr.	+					
Brown Cr.	+	+	+	+	+	a
Bumblebee Cr.	+	+	+	+		
Canyon Cr.	+					a
Clark Cr.	+					
Coal Cr.	+		+			a
Copper Cr.	+	+		+	-	a,c
Cougar Gulch	+	+	+	+		a,b,c
Eagle Cr.	+			+		a
W. Fk. Eagle Cr.	+			+		a
E. Fk. Eagle Cr.	+			+		a
Evans Cr.	+			+		a
Fortier Cr.	+			+		a,b
Fourth of July Cr.	+			+		a,c
French Gulch	+	+	+	+		a,c
Gimlet Cr.		+		+		
Graham Cr.	+	+	+	+	+	
Grizzly Cr.	+	+	+	+		a
Hecla Channel	+	+	+	+		a,k,l
Hunt Gulch	+			+		h
Latour Cr.	+			+		a
Little Teepee Cr.				+		a
Lost Cr.	+	+	+	+		a,b
E. Fk. Lost Cr.	+	+	+	+		a
Hat Cr.	+	+	+			
N. Fk. Coeur d'Alene R.	+	+		+		a
E. Fk. Pine Cr.	+			+		a,c,d
Trapper Cr.	+			+		a
Robinson Cr.	+					
Rose Cr.	+					
Scott Cr.	+	+	+			a
Skeel Gulch	+					
Steamboat Cr.	+	+	+		+	a
Thompson Cr.	+			+		j
W. Fk. Thompson Cr.	+			+		
Willow Cr.	+					a,c

Table 5, continued.

Cutthroat Stream	trout	Species present				Other species
		Rainbow trout	Hybrid RBT-CTT	Brook trout	Bull trout	
St. Joe River						
Benewah Cr.	+		+	+		a,b,c, e,f,g
Bond Cr.	+			+		a,b,d, e,i
Cherry Cr.	+		+		+	
Falls Cr.	+			+		a
Hugus Cr.	+			+		a,d,e
Mica Cr.	+	+	+	+	+	a,b,d
Moose Cr.	+			+		a
Reeds Gulch	+			+		a
Rochat Cr.	+			+		a
Street Cr.	+		+	+		a,i
Thomas Cr.	+			+	+	a
Trout Cr.	+	+	+	+	+	a
Whittenburg Draw				+		
St. Maries River						
Alder Cr.	+			+		a,b,c,d.
Beaver Cr.	+			+		a,b,e
Blair Cr.	+					a
Carlin Cr.	+					a
Carpenter Cr.	+			+		a,b,e
Cat Spur Cr.	+			+		a
Kitten Cr.	+					a
Childs Cr.,	+					a
Crystal Cr.	+			+		a
Flat Cr.	+			+		a,b
John Cr.	+			+		a,d
Merry Cr.	+	+	+			a,b,c
W. Fk. Merry Cr.	+					a,b
Mann Cr.	+					a
M. Fk. St. Maries R.	+	+				a,b,c,d e,i
Olson Cr.	+	+		+		a
Renfro Cr.	+	+		+		a,b,i
Davis Cr.	+			+		a
Santa Cr.	+					a,b,c,e
Charlie Cr.	+			+		a,b,c,e
Hume Cr.	+					a
Sheep Cr.	+					b
Soldier Cr.	+					a
Thorn Cr.	+		+	+	+	a,b,c,f g,h,i
Canyon Cr.	+					a

Table 5, continued.

Stream	Species present					
	Cutthroat trout	Rainbo w	Hybrid RBT-CTT	Brook trout	Bull trout	Other species
St. Maries River (cont.)						
Tyson Cr.						a,b,e
W. Fk. St. Maries R.	+					a,b,c,d e

Key: a = sculpin species g = yellow perch
 b = dace species h = bullhead catfish species
 c = sucker species I = mountain whitefish
 d = northern squawfish j = pumpkinseeds
 e = redbside shiner k = kokanee salmon
 f = largemouth bass l = chinook salmon

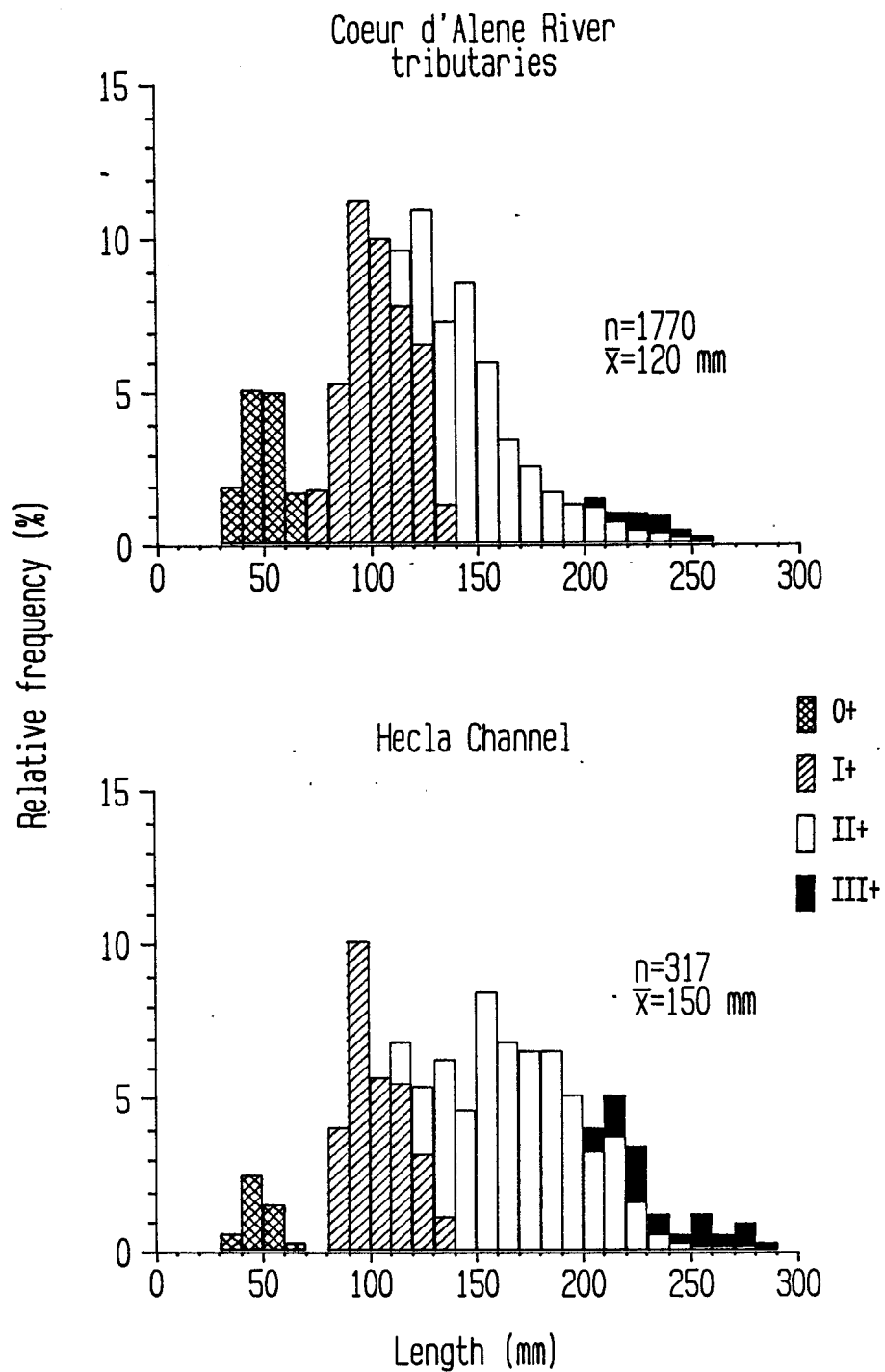


Figure 10. Length frequencies of cutthroat trout in 31 tributaries to the Coeur d'Alene River, 1984 and 1985; and in Hecla Channel, 1984.

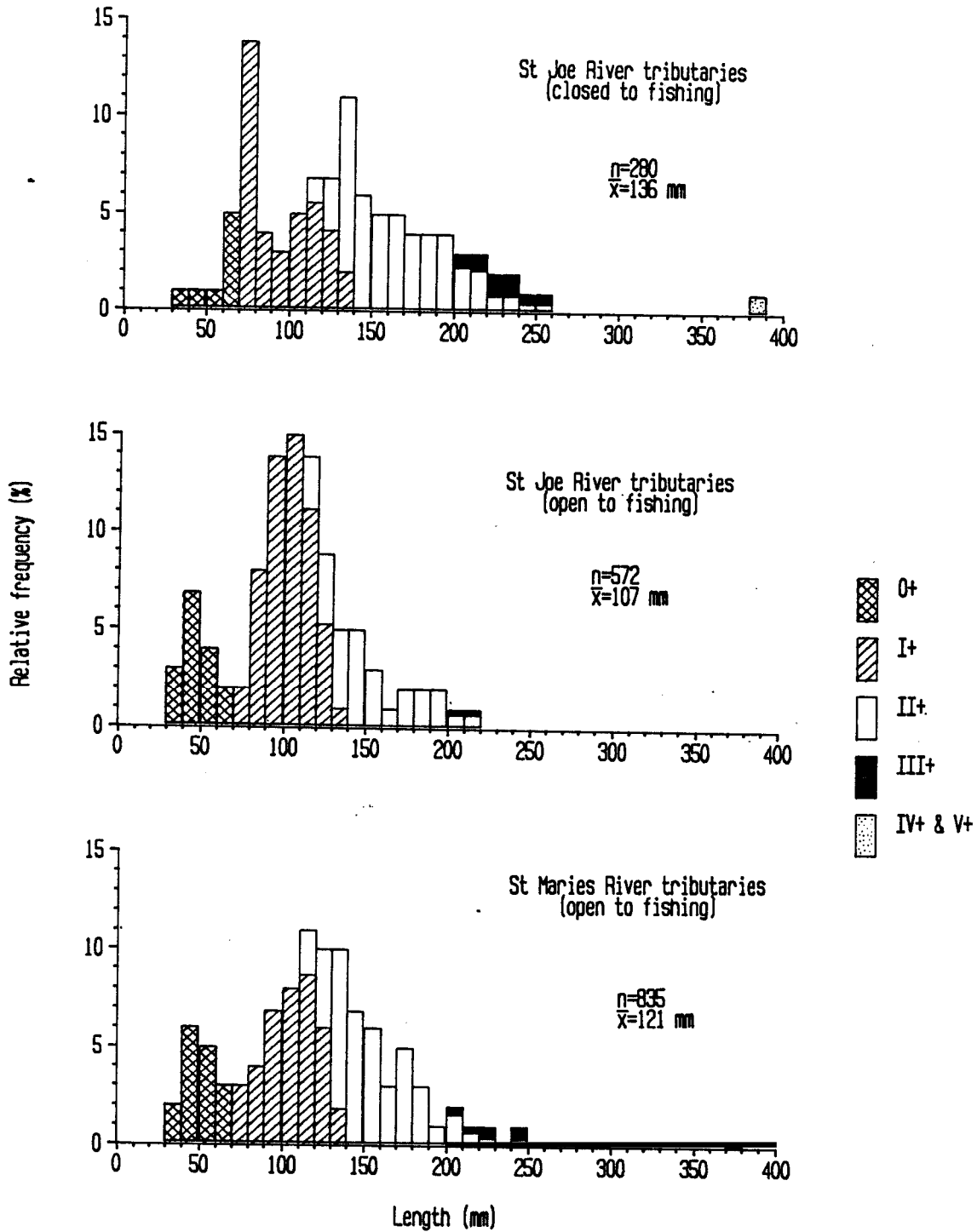


Figure 11. Length frequencies of cutthroat trout in four tributaries closed to fishing and six tributaries open to fishing in the St. Joe River drainage, 1986; and in 23 tributaries to the St. Maries River, 1987.

groups of streams. Falls Creek was omitted from this comparison among streams because a barrier at the mouth precludes the presence of migratory populations. Age distribution of cutthroat trout in Falls Creek was similar to the other streams that were open to fishing.

Jacot Creek, Mercury Creek, Miesen Draw, Phillips Draw, and Hells Gulch were intermittent streams, and/or severely degraded, and were not studied.

Tributaries to the St. Maries River had an overall lower diversity of salmonids than did the Coeur d'Alene and St. Joe river drainages, with cutthroat trout dominant. Rainbow trout were scarce, found in only three of 23 tributaries surveyed. Bull trout were found in Thorn Creek only.

Length frequencies of cutthroat trout in tributaries to the St. Maries River were similar to those in tributaries to the Coeur d'Alene River, with a mean length of 121 mm and dominated by age II fish (Figure 11; Appendix J).

Tributary Snorkeling

Coeur d'Alene River. Cutthroat trout were observed in all tributaries that were snorkeled except Site 2 of the North Fork Coeur d'Alene River (Table 6). Rainbow trout were the most abundant species in snorkeled transects of Brown Creek, Cougar Gulch, Steamboat Creek, and the North Fork Coeur d'Alene River (Site 1). Brook trout were observed in relatively low numbers in less than half of the tributaries snorkeled. 'Bull and cutthroat-rainbow hybrid trout were not observed. Tributary densities ranged from zero to 74.4 trout/100 m². Young-of-the-year (YOY) trout were observed in all tributaries, with the exception of Graham Creek. Cutthroat trout YOY were seen in all tributaries except Bumblebee and Graham creeks and the North Fork Coeur d'Alene River (Site 2). Tributaries with densities exceeding 18 trout/100 m² were comprised of more than 65% YOY.

St. Joe River. Trout densities ranged from 1.0 to 132.5 fish/100 m² in tributaries to the St. Joe River (Table 6). Cutthroat trout were observed in all tributaries snorkeled with the exception of Reeds Gulch. Densities of cutthroat trout YOY were low compared to those in the other two drainages. The highest cutthroat trout density observed was in Trout Creek and the lowest was in Mica Creek. Both of these tributaries have been closed to fishing since 1973. Rainbow trout were present only in Mica Creek. Cutthroat-rainbow hybrid trout were observed in Bond, Mica, and Trout creeks, but at densities less than 1.0 trout/100 m². Brook trout were observed in all tributaries and was the most abundant species in Reeds Gulch. Bull trout were not observed.

St. Maries River. Trout densities ranged from 0.7 to 26.9 fish/100 m² in tributaries to the St. Maries River (Table 6). Cutthroat trout densities were highest in Merry Creek. Cutthroat trout YOY were not observed in the West Fork Merry and Olson creeks, nor in the Middle Fork

Table 6. Summary of fish densities (fish/100 m²) observed in snorkeling transects in tributaries to the Coeur d'Alene, St. Joe, and St. Maries rivers, 1984 through 1987.

Stream	Transect location (T,R,Sec.) ^b	Date	Water temp (°C)	Fish species											Total salmonid species	
				Cutthroat trout		Rainbow trout		Hybrid RBT-CTT trout		Unidentified Salmo species		Brook trout		Other fish		
				Fry ^a	>70 mm	Fry	>70 mm	Fry	>70 mm	Fry	>70 mm	Fry	>70 mm			
Coeur d'Alene River																
Brown Cr.	50N,3E,23	8-26-84	--	7.6	1.7	38.7	4.2	0	0	0	0	0	0	0	52.2	
	50N,3E,23	9-25-85	9.0	0	0.7	0	4.1	0	0	13.0	0	0	0	0.7 ¹	17.8	
Bumblebee Cr. (Site 1)	50N,1E,SW1/4,36	9-14-84	9.5	0	1.4	0	0	0	0	0	0	0	0	0	1.4	
	50N,1E,SW1/4,36	8-23-85	9.0	0	0	0	1.8	0	0	0	0	0.5	0.5	0	2.8	
(Site 2)	50N,1E,NW1/4,25	9-14-84	9.0	0	0	0	2.8		0	0	0.7	0	3.5	0	7.0	
	50N,1E,NW1/4,25	8-23-85	9.5	0	1.5	0	1.5		0	1.5	0	1.5	0	0	6.0	
Coal Cr.	50N,3E,30	8-26-84	10.0	0	9.6	0	0	0	0	0	0	0	0	0	9.6	
	50N,3E,30	8-28-85	10.0	1.7	8.3	0	0	0	0	0	0	0	0	1.7 ¹	10.0	
Copper Cr.	50N,1E,SW1/4,30	8-25-84	--	0	1.6	0	0	0	0	0.5	0	0	2.6	0	4.7	
	50N,1E,SW1/4,30	8-23-85	13.0	0.2	2.4	2.4	0.6	0	0	0	0	3.4	1.2	0.2 ¹	10.2	
Cougar Gulch (Site 1)	50N,2E,NW1/4,34	9-14-84	12.0	11.1	7.2	9.6	8.0	0	0	0	0	0	0	0	35.9	
	50N,2E,SW1/4,34	9-25-85	11.0	0	0.8	41.8	6.8	0	0	0	3.2	0	0	0	52.6	
(Site 2)	50N,2E,NW1/4,18	8-26-85		0.7	7.9	5.7	1.8	0	0	0	1.4	0	0	0	17.5	

Table 6, continued.

Stream	Transect location (T,R,Sec.) ^b	Date	Water temp. (°C)	Cutthroat trout Fry ^a >70 mm		Fish species										Total salmonid species
						Rainbow trout		Hybrid RBT-CTT trout		Unidentified <u>Salmo</u> species		Brook trout		Other fish		
						Fry >70 mm		Fry >70 mm		Fry >70 mm		Fry >70 mm				
Coeur d'Alene River (cont.)																
Evans Cr. (Site 1)	47N,2W,NW1/4,3	8-20-84	17.8	21.7	5.8	0	0	0	0	0	0	0	0	0		27.5
(Site 2)	47N,2W,NW1/4,11	8-20-84	13.3	12.9	9.2	0		0	0	0	0	0	0	0		22.1
Fortier Cr.	48N,2W,NE1/4,3	8-21-84	15.5	33.7	8.4	0	0	0	0	0	0	1.7	2.5	5.9 ³		46.3
Graham Cr.	50N,3E,NW1/4,33	8-26-84	14.0	0	0.8	0	0	0	0	0	0	0	3.2	0		4.0
	50N,3E,NW1/4,33	8-25-85		0	1.1	0	0	0	0	0	0	0	1.9	0		3.0
Grizzly Cr.	50N,3E,SW1/4,22	9-25-85	8.0	1.8	4.9	0	0	0	0	0	0.6	0	0	0		7.3
Latour Cr.	48N,1E,SW1/4,5	9-14-84	12.0	5.3	1.2	0	0	0	0	0	0	0	0	0		6.5
NF CdA River (Site 1)	50N,1E,SW1/4,36	8-23-85	13.5	0.9	0	1.5	1.8	0	0	0.1	0.3	<0.1	0	0.4 ^{3,4}		4.6
(Site 2)	50N,1E,NE1/4,7	8-25-84	21.1	0	0			0	0	0	0	0	0	2.3 ³⁴		0
	50N,1E,NE1/4,7	8-23-85	14.0	0	0			0	0	0	0	0	0	1.4 ³⁴		0
Scott Cr.	50N,2E,SW1/4,24	9-25-85	9.0	1.3	5.2	0	0	0	0	0	0	0	0	0		6.5
Steamboat Cr. (Site 1)	50N,2E,NE1/4,14	8-22-84	15.5	3.5	0.7	6.4	1.8	0	0	0	0	0.2	0.5	0.3 ¹		13.1
	50N,2E,NE1/4,14	9-25-85	10.0	0	0.2	0	0.6	0	0	1.1	0	0	0	0		1.9

Table 6, continued.

Stream	water temp.	Fish species													
		Cutthroat	Rainbow trout	RBT-CTT trout	Hybrid		Unidentified		Total		Other	salmonid	fish	species	
					Salmo	Brook	trout	species	trout	trout					
Transect location	Date	(°C)	Fry ^a	>70 mm	Fry	>70 mm	Fry	>70 mm	Fry	>70 mm	Fry	>70 mm			
(T,R,Sec.) ^b															
Coeur d'Alene River (cont.)															
Steamboat Cr. (cont.)															
(Site 2)	50N,2E,NW1/4,11	8-22-84	12.2	4.4	1.4	1.7	0.6	0	0	4.2	1.1	0	0	0.3 ¹	13.4
	50N,2E,NW1/4,11	9-25-85	9.0	0	0	0	0	0	0	5.1	0	0	0	0	5.1
EF Steamboat Cr.	51N,2E,NW1/4,34	8-22-84	12.2	2.0	8.0	0	0	0	0	0	0	0	0	0.7 ¹	10.0
	51,2E, NW1/4,34	9-25-85	10.5	3.0	0.5	0	0	0	0	0	0.7	0	0	0	4.2
WF Steamboat Cr.	50N,2E,NE1/4,4	8-22-84	9.4	0.6	3.7	0	0	0	0	0	0	0	0	1.2 ¹	4.3
	50N,2E,NE1/4,4	9-25-85	7.0	0	0	0	0	0	0	0	0	0	0	0	0
Willow Cr. (Site 1)	47N,2W,NW1/4,4	8-20-84	15.0	74.4	0		0	0	0	0	0	0	0	29.2 ³	74.4
	47N,2W,SE1/4,4	8-20-84	13.3	11.2	1.9	0	0	0	0	26.0	0	0	0	10.2 ^{1,3}	39.1
St. Joe River															
Benewah Cr.															
(Site 1)	46N,3W,SW1/4,14	8-29-86	19.0	0	1.4	0	0	0	0	0	0	0	0	83.7 ^{2,3,5,6}	1.4
(Site 2)	46N,3W,NE1/4,27	8-29-86	18.0	1.1	2.1	0	0	0	0	0	0	0	0	135.8 ^{1,2,3,5}	3.2
(Site 3)	45N,3W,NW1/4,24	8-29-86	17.0	2.7	0	0	0	0	0	6.8	0	1.4	0	2.7 ⁵	10.9

Table 6, continued.

Stream	Transect location (T, R, Sec.) ^b	Date	water temp. (°C)	Fish species											Total salmonid species
				Cutthroat trout		Rainbow trout		Hybrid RBT-CTT trout		Unidentified <i>Salmo</i> species		Brook trout		other fish	
				Fry ^a >70 mm		Fry >70 mm		Fry >70 mm		Fry >70 mm		Fry >70 mm			
St. Joe River (cont.)															
Bond Cr. (Site 1)	46N,1E,SE1/4,28	9-11-86	13.0	1.1	0.5	0	0	0	0	0	0	0	0.5	23.2 ^{1,3,4,5}	2.1
(Site 2)	46N,1E,NW1/4,34	9-11-86	13.0	1.2	2.8	0	0	0	0.4	0	0	0.4	0.8	7.6 ^{1,2,3,4}	5.6
Mica Cr. (Site 1)	45N,3E,NW1/4,7	8-27-86	19.0	0	0	0	2.3	0	0.4	0	0	0	0	1.5 ⁴	2.7
(Site 2)	45N,3E,NW1/4,18	8-27-86	17.0	0	0	0	0	0	0.5	0.5	0	0	0	0	1.0
(Site 3)	45N,2E,NE1/4,33	9-19-86	12.0	0.2	1.7	0	0	0	0	0	0	0.2	6.5	0	8.6
Reeds Gulch	46N,1E,NE1/4,19	8-27-86	13.0	0	0	0	0	0	0	0	0	119.5	13.0	0	132.5
Trout Cr. (Site 1)	46N,2E,NE1/4,31	9-17-86	12.0	9.0	5.5	0	0	0	0.8	0	0.4	0	0.4	0.8 ¹	16.1
(Site 2)	46N,2E,SE1/4,5	9-17-87	10.5	14.3	44.3	0	0	0	0	0	0	0	0	0	58.6
St. Maries River															
Alder Cr. (Site 1)	45N,2W,NW1/4,32	8-28-86	18.0	3.0	0.8	0	0	0	0	0	0	0	0	10.5 ^{1,3,4}	3.8
(Site 2)	45N,3W,SE1/4,35	8-28-86	20.5	8.3	5.9	0	0	0	0	0	0	2.4	1.2	11.8 ¹	17.8

Table 6, continued.

Stream	Transect location (T,R,Sec.) ^b	Date	water temp salmonid (°C)	Cutthroat, Fry ^a >70 mm				Rainbow trout Fry >70 mm				Fish species					Total Other species		
												Hybrid		Unidentified		Brook species		trout	fish
												RBT-CTT trout	Salmo trout	Salmo trout	trout				
St. Maries River (cont.)																			
John Cr. '	45N,2W,NW1/4,33	08-28-86	21.0	0.7	0	0	0	0	0	0	0	0	0	0	1.4 ^{1,4}	Q.7			
Merry Cr. (Site 1)	42N,2E,NW1/4,4	09-03-87	14.0	0.5	7.1	0	0	0	0	0	0	0	0	0	1	7.6			
(Site 2)	43N,2E,SW1/4,23	09-03-87	12.0	14.6	11.6	0	0	0	0.7	0	0	0	0	0	1	26.9			
WF Merry Cr.	43N,2E,NW1/4,33	09-03-87	12.0	0	3.3	0	0	0	0	0	0	0	0.8	0		4.1			
MF St. Maries R.	42N,2E,NE1/4,9	09-03-87	17.0	0	0.8	0	0.2	0	0	0	0	0	0			1.0			
Olson Cr.	43N,1E,SE1/4,9	09-04-87	10.0	0	1.5	0	0	0	0	0	1.5	0.5	0.5		1	4.0			

^aFish <70 mm.^bTownship, Range, Section number.

Key:

- 1 = Sculpin
- 2 = Dace species
- 3 = Sucker species
- 4 = Northern squawfish
- 5 = Redside shiner
- 6 = Largemouth bass
- 7 = Mountain whitefish

St. Maries River. Rainbow and cutthroat-rainbow hybrid trout were only present in Middle Fork St. Maries River and Merry Creek, respectively. Brook trout were observed in the West Fork Merry and Olson creeks. Bull trout were not observed.

Fish Movement

Coeur d'Alene Lake

Browns Bay was the only sampled location in the lake where cutthroat trout were caught with the purse seine. Two of the 39 cutthroat trout tagged in the lake with reward tags were later caught in the lower rivers: one in the St. Joe River and one in the Coeur d'Alene River (Table 7). Four of the tagged fish have been recovered within the main lake.

Coeur d'Alene River

Anglers returned 34 of the 201 cutthroat trout jaw tags from the Coeur d'Alene River drainage. Most (26) of the tagged fish were recovered within 10 km of their tagging location (Table 8). Thirteen of the 14 returns from cutthroat trout tagged at French Gulch were recovered within 7 to 11 km downstream (in the Cataldo and Cataldo Mission area) within 3 months. The one exception was found 1 km upstream from French Gulch two months after being tagged. All recovered cutthroat trout that were tagged in the Cataldo, Cataldo Mission, and Dudley areas were harvested in those general locations from one to 17 months after being tagged. Three cutthroat trout tagged in the Cataldo area in May and July were recaptured with electrofishing gear in the summer and fall at the same locations. One adult cutthroat-rainbow trout hybrid was tagged in the Cataldo area in July 1985 and recovered with electrofishing gear in July 1986 in the same location. That fish grew from 322 mm to 425 mm in one year. One rainbow trout was recaptured in July at Cataldo after being tagged there in May. Only two of the 1,139 cutthroat trout that were tagged with Floy FTF-69 fingerling tags were recaptured by anglers. One fish was caught at Cataldo Mission, 32 km upstream from where it had been tagged in Willow Creek 1 year earlier. The other fish was caught two weeks after being tagged within the same tributary. A juvenile cutthroat-rainbow trout hybrid that was tagged in Steamboat Creek traveled downstream 13 km to Freeman Eddy over a 10-month period (August to June). Another hybrid that was tagged as a juvenile in Lost Creek was recovered 16 km downstream, near Browns Creek, the following spring.

St. Joe River

Jaw tags were put on 63 cutthroat trout throughout the St. Joe River study area, and 10 were recaptured by anglers (Table 9). One fish, caught the year after tagging, had not moved. Four fish moved downstream and four moved upstream before being caught by anglers. The furthest movement recorded was for a cutthroat trout that swam upstream from Big Eddy to Bluff Creek (64 km) over a 10-month period from October to August. The

Table 7. Angler recoveries of cutthroat trout tagged in Lake Coeur d'Alene.

Tag no. ^a	Date & location tagged		Date & location recovered		Length	Movement
					tagged/recovered	
2085	11-04-86	Browns Pt.	08-01-87	Conklin Park	301/318	2 km down lake
2067	11-04-86	Browns Pt.	05-25-87	Near Carlin Bay	305/310	16 km up lake
2063	11-04-86	Browns Pt.	05-25-87	Coeur d'Alene R. @ Cataldo	347/--	48 km upstream
2095	11-05-86	Browns Pt.	05-25-87	Near Conklin Park	288/356	2 km up lake
2070	11-04-86	Browns Pt.	06-14-87	Spokane Point	338/338	3 km down lake
7	11-04-86	Browns Pt.	03-??-87	St. Joe R. @ Hells Gulch	--/--	16 km upstream

^aReward Floy tags were used on all fish tagged in the lake.

Table 8. Angler recoveries of tagged cutthroat trout within the Coeur d'Alene River drainage.

no.	Date & location to	Date & location recovered	Length tagged/recovered	Movement
FT-Y 048	07-12-84 Evans Cr.	07-18-84 Evans Cr.	144/144	No movement
FT-Y 947	07-10-85 Willow Cr.	06-12-86 River @ Mission	135/228	32 km upstream
JT J0810	05-07-85 French Gulch	05-25-85 River @ Mission	408/408	11 km, downstream
JT J0859	05-01-85 French Gulch	05-26-85 River @ Mission	373/373	11 km downstream
JT J0838	04-29-85 Skeel Gulch	05-26-85 Skeel Gulch	340/340	No movement
REW 4	05-05-85 French Gulch	06-06-85 River @ Cataldo	371/387	7 km downstream
REW 8	05-07-85 French Gulch	06-12-85 River @ Dudley	290/305	15 km downstream
REW 10	05-13-85 French Gulch	06-12-85 River @ Cataldo	285/290	7 km downstream
JT F0044	05-06-85 French Gulch	06-15-85 River @ Mission	402/406	11 km downstream
JT J0802	04-12-85 French Gulch	06-15-85 River @ Mission	334/334	11 km downstream
JT J0857	05-01-85 French Gulch	06-16-85 River @ Mission	322/322	11 km downstream
JT J0830	04-29-85 French Gulch	06-25-85 River @ Kingston	373/373	1 km upstream
REW 16	05-30-85 French Gulch	06-??-85 River @ Mission	314/320	11 km downstream
JT J0826	05-24-85 River @ Dudley	06-??-85 River @ Mission	250/--	6 km upstream
JT J0854	05-30-85 French Gulch	07-06-85 River @ Mission	396/405	11 km downstream
REW 12	05-20-85 French Gulch	07-??-85 River @ Skeel Gulch	387/395	9 km downstream
REW 6	05-07-85 French Gulch	08-18-85 River @ Cataldo	335/345	7 km downstream
JT F0036	05-03-85 Skeel Gulch	05-28-86 River @ Skeel Gulch	373/381	1 km downstream

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Table 8, continued.

Tag no. ^a	Date & location tagged	Date & location recovered	Length		Movement
			tagged/recovered		
JT J0703	06-1615 River @ Fast Hill	06-05-86 River @ Latour Cr.	358/368		8 km downstream
REW 15	05-30-85 French Gulch	06-06-85 River @ Cataldo	384/387		7 km downstream
REW 118	05-22-86 River @ Mission	10-19-86 River @ Mission	312/368		No movement
JT C10703	05-09-86 River @ Mission	09-03-86 River @ Mission	372/419		No movement
JT F0047	05-16-86 River @ Mission	05-24-86 River @ Mission	368/368		No movement
REW 101	05-01-86 River @ Cataldo	06-05-86 River @ Cataldo	330/--		No movement
JT F0076	05-01-86 River @ Cataldo	06-07-86 River @ Cataldo	368/--		No movement
REW 115	05-22-86 River @ Cataldo	05-24-86 River @ Dudley	288/288		8 km downstream
REW 116	05-22-86 River @ Cataldo	05-24-86 River @ Dudley	282/282		8 km downstream
REW 137	06-17-86 River @ Freeman Eddy	06-17-87 River @ Freeman Eddy	295/--		No movement
JT J0905	09-20-86 River @ Cinnamon Cr.	06-06-87 River @ Kit Price Campgr.	320/356		16 km downstream
JT J0889	07-01-86 River @ Mission	05-23-87 River @ Mission	240/--		No movement
JT C10796	10-13-86 River @ Cataldo	05-25-87 River @ Cataldo	405/559		No movement
REW 140	07-01-86 River @ Cataldo	05-23-87 River @ Cataldo	295/343		No movement
JT F0045	05-01-86 River @ Mission	10-30-87 River @ Mission	361/430		No movement
JT F0086	07-01-86 River @ Mission	10-17-87 River @ Mission	400/400		No movement
REW 107	05-01-86 River @ Mission	10-07-87 River @ Mission	272/300		No movement
REW 128	05-22-86 River @ Mission	06-06-87 River @ Mission	310/--		No movement

^aREW = reward jaw tag; JT = non-reward jaw tag; FT-Y = yellow Floy FTF-69 fingerling tag.

Table 9. Angler recoveries of tagged cutthroat trout within the St. Joe River drainage.

Tag no. ^a	Date & location tagged	Date & location recovered	Length	Movement
			tagged/recovered	
JT J0926	06-02-86 River @ Bond Cr.	06-//-87 River @ Hugus Cr.	257/--	11 km upstream
REW 145	10-23-86 River @ Big Eddy	08-16-87 River @ Bluff Cr.	234/279	64 km upstream
FT-G 497	07-10-86 Cherry Cr.	06-12-87 Cherry Cr.	150/152	No movement
JT J0935	10-23-86 River @ Falls Cr.	06-24-87 Hoyt Flat	260/267	24 km upstream
JT J0909	10-06-86 River @ Simmons Cr.	06-17-87 River @ Avery	233/305	42 km downstream
REW 144	10-24-86 River @ Calder	07-04-87 River @ Big Cr.	297/--	No movement
JT F0003	04-15-86 Benewah Cr.	05-28-86 Thoroughfare between Chatcolet & Coeur d'Alene lakes	345/345	19 km downstream
JT F0052	04-30-86 Benewah Cr.	06-01-86 Chatcolet Lk.	302/320	13 km downstream
JT F0082	04-30-86 River @ Hugus Cr..	06-15-86 River @ Avery	282/290	42 km upstream
JT C10726	10-23-86 River @ Moose Cr.	10-27-86 River @ Big Eddy	378/378	7 km downstream
JT F0061	06-02-86 River @ Bond Cr.	06-??-86 River @ Bond Cr.	332/332	No movement

^aREW = reward jaw tag; JT = non-reward tag; FT-G = green Floy FTF-69 fingerling tag.

fastest movement documented was for a cutthroat trout tagged in the river at Hugus Creek in April and recovered 42 km upstream 6 weeks later. Two cutthroat trout tagged in Benewah Creek in April were recovered in Chatcolet Lake and in the thoroughfare between Chatcolet and Coeur d'Alene lakes four and six weeks later. One cutthroat-rainbow trout hybrid, tagged during the summer in Mica Creek, was recovered the following May in the river near Falls Creek, 14 km downstream. Floy FTF-69 fingerling tags were put on 540 juvenile cutthroat trout throughout the drainage. One Floy-tagged fish was recovered the next year in the same tributary.

St. Maries River

Jaw tags were put on 34 cutthroat trout in the St. Maries River drainage and 6 have been recovered by anglers (Table 10). Two of the fish had not moved from their tagging location and were caught one and five months after being tagged. Four fish had moved between six and 32 km downstream and were caught within five weeks of tagging. Floy tags were put on 407 juvenile cutthroat trout and one was recaptured 10 months after being tagged in the same tributary.

Use of Tributaries

Adult cutthroat trout were found moving into several tributaries prior to spawning and/or out of tributaries after spawning (Table 11). Adult cutthroat-trout were found entering French Gulch late March through early May. Spawned adults emigrated from French Gulch throughout May. Adults emigrated from Skeel Gulch at the end of April. One adult was trapped entering Cougar Gulch on April 29. General adult emigration from tributaries was during high spring flows. Mean length of spawning cutthroat trout was 353 mm in the Coeur d'Alene River drainage (Figure 12). Several lower river tributaries were used by adult trout during summer, presumably avoiding high temperatures in the main rivers. Juvenile cutthroat trout emigrated from tributaries during high spring flows (Figure 13). Migratory cutthroat trout were trapped in French Gulch, Hunt Gulch, Cougar Gulch, Skeel Gulch, and Scott Creek in the Coeur d'Alene River drainage; in Benewah Creek, Cherry Creek, Mica Creek, Reeds Gulch, Street Creek, Thomas Creek, and Trout Creek in the St. Joe River drainage; and in Thorn Creek, Merry Creek, and the West and Middle forks of the St. Maries River drainage.

DISCUSSION

A viable trout fishery currently exists below the South Fork of the Coeur d'Alene River. This fishery exemplifies the resiliency of a system which has suffered severe perturbations. Unstratified weekend creel surveys conducted in 1984 and 1985 indicated the majority of angling effort occurred before the July Fourth holiday. This high-use, short-term fishery in the lower Coeur d'Alene River prompted a random stratified creel survey which had never been conducted prior to our evaluation.

Table 10. Angler recoveries of tagged cutthroat trout within the St. Maries River drainage.

Tag no. ^a	Date & location tagged		Date & location recovered		Length	Movement
					tagged/recovered	
REW 133	05-05-87	River @ Clarkia	06-17-87	River @ Emerald Cr.	238/--	11 km downstream
JT F0066	05-05-87	River @ Clarkia	05-23-87	River @ John Cr.	345/345	32 km downstream
REW 129	05-04-87	River @ Merry Cr.	05-23-87	River @ John Cr.	328/328	32 km downstream
REW 146	05-20-87	River @ Clarkia	06-13-87	River @ Emerald Cr.	230/230	6 km downstream
FT-B 546	08-19-86	Alder Cr.	05-31-87	Alder Cr.	210/--	No movement
REW 148	05-20-87	River @ Clarkia	10-08-87	River @ Clarkia	237/240	No movement
JT J0032	05-20-87	River @ Clarkia	06-25-87	River @ Clarkia	196/237	No movement

^aREW = reward jaw tag; JT = non-reward jaw tag; FT-B = blue Floy FTF-69 fingerling tag.

Table 11. Catch of salmonids in migratory fish traps placed in tributaries to the Coeur d'Alene River, 1985; the St. Joe River, 1986; and the St. Maries River, 1986 and 1987.

Drainage	Trap ^b	Species captured ^a									
		CTT		RBT		HYB		BKT		BLT	
Stream		Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult
Coeur d'Alene River											
French Gulch	UT	0	55	0	0	0	0	1	0	0	0
	DT	6	54	0	1	0	2	0	0	0	0
Hunt Gulch	UT	0	1	0	0	0	0	0	0	0	0
	DT	11	0	0	0	0	0	0	0	0	0
Cougar Gulch	UT	0	1	0	0	0	1	0	0	0	0
	DT	23	0	0	0	4	0	0	0	0	0
Brown Creek	UT	0	0	0	4	0	0	0	0	0	0
	DT	0	0	0	0	0	0	0	0	0	0
Skeel Gulch	UT	0	1	0	0	0	0	0	0	0	0
	DT	5	17	0	0	0	0	0	0	0	0
Scott Creek	DT	2	0	0	0	0	0	0	0	0	0
St. Joe River											
Benewah Creek	DT	141	7	0	0	6	0	0	0	0	0
Cherry Creek	DT	3	1	0	0	0	0	1	0	1	0
Hugus Creek	DT	0	0	0	0	0	0	0	0	0	0
Mica Creek	DT	1	0	0	0	1	0	0	0	0	0
Reeds Gulch	DT	1	0	0	0	0	0	1	0	0	0

Table 11, continued.

Species captured^a

Drainage Stream	Trap ^b	CTT		RBT		HYB		BKT		BLT	
		Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult
St. Joe River (continued)											
Street Creek	DT	1	0	0	0	0	0	4	0	0	0
Thomas Creek	DT	1	0	0	0	2		0	0	0	0
Trout Creek	DT	1	0	0	0	1	0	0	0	0	0
Whittenburg Draw	DT	0	0	0	0	0	0	0	0	0	0
St. Maries River											
Thorn Creek ^c	DT	33	0	0	0		0	1	0	1	0
Merry Creek ^d	DT	29	2	0	1	2	0	0	0	U	0
West Fork ^d	DT	4	0	0	0	0	0	0	0	0	0
Middle Fork ^d	DT	17	0	0	0	0	0	0	0	0	0

^aCTT = cutthroat trout

RBT = rainbow trout

HYB = cutthroat-rainbow trout hybrid

BKT = brook trout

BLT = bull trout

^bUT = upstream migrant trap

DT = downstream migrant trap

^cSampling done in 1986.^dSampling done in 1987.

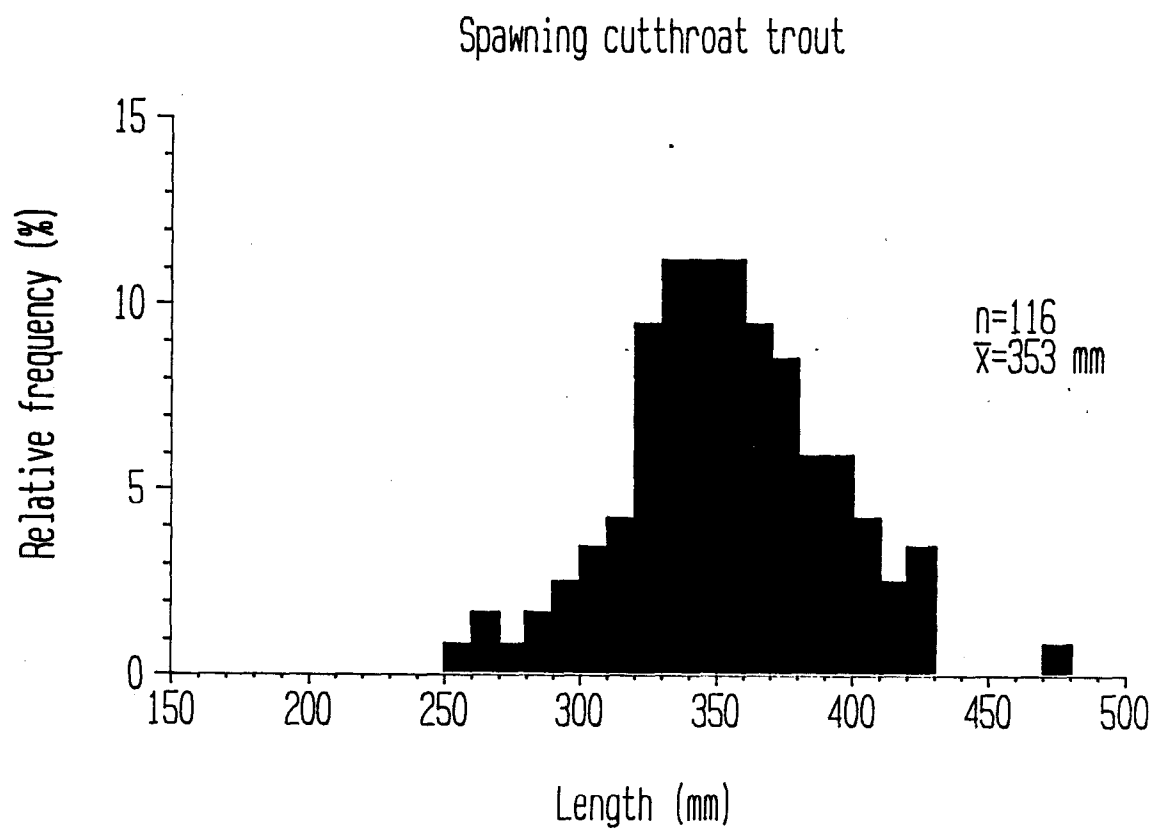


Figure 12. Length frequency of spawning cutthroat trout in the Coeur d'Alene River drainage, 1986.

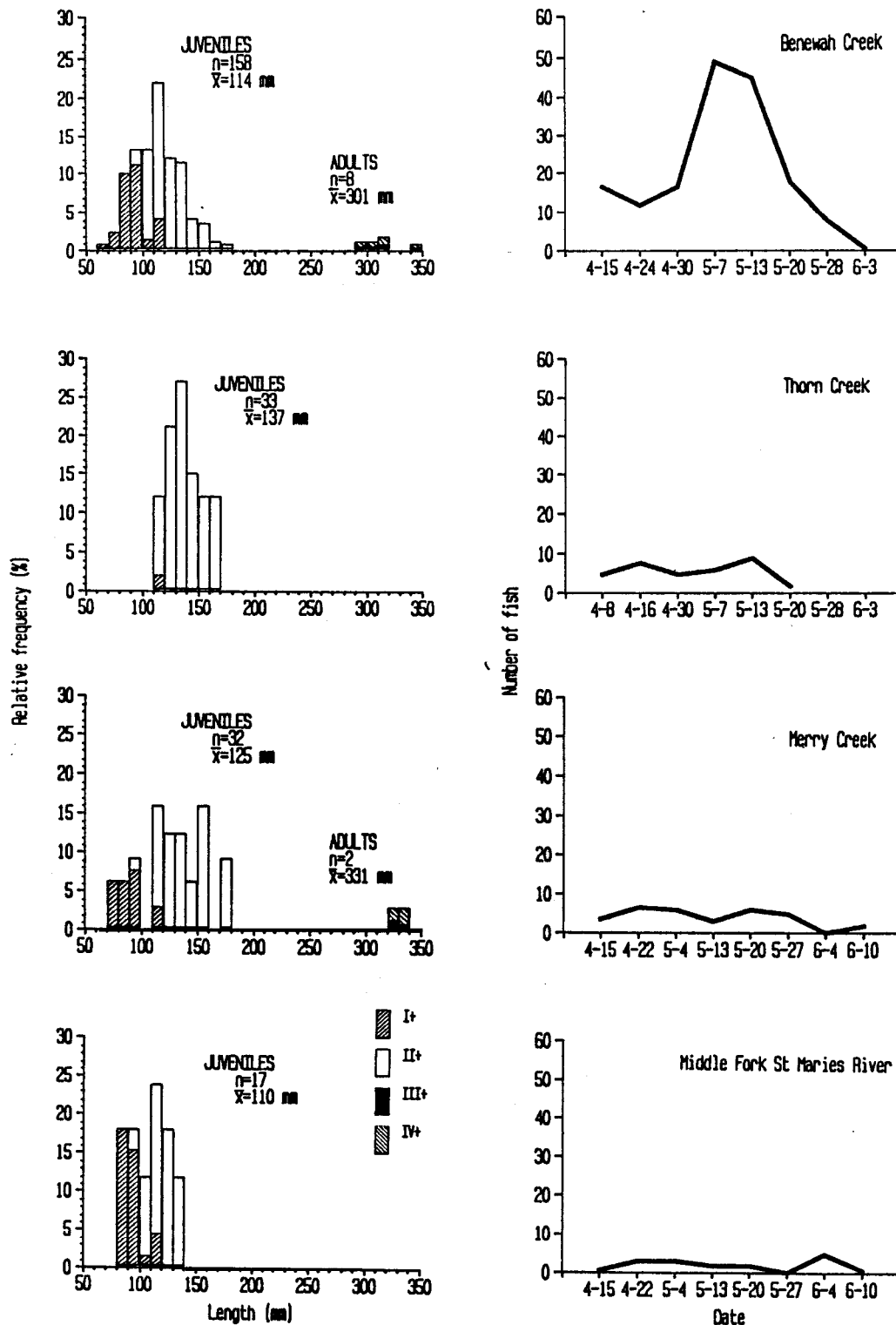


Figure 13. Timing and age frequencies of juvenile cutthroat trout emigrants from Benewah and Thorn creeks, 1986; and Merry Creek and Middle Fork St. Maries River, 1987.

A trend similar to 1984 and 1985 was observed in 1986 when most of the angling effort during the survey occurred during Interval 1. The dramatic decline in angler effort and cutthroat trout harvest as the survey progressed was probably a function of overexploitation, movement of migratory stocks, and reduced water levels. Section 3 showed the most illustrated example of a high-yield, short-term fishery. This section was extremely popular with boat anglers who accounted for 52% of the total cutthroat trout harvest for all sections, but the bulk of boat effort (60%) and cutthroat trout harvest (902) occurred during Interval 1. Cutthroat trout were particularly vulnerable to boat angling, especially when drifting bait. Shore anglers, with comparable effort, harvested only 19% of the cutthroat trout from Section 3.

A comparison of age-length frequencies of harvested and spawning cutthroat trout in the Coeur d'Alene River showed most of the harvested fish were sexually immature (Figure 14). Our data supports the suggestion by Lewynsky and Bjornn (1983) that the 330 mm minimum size restriction, established in the upper St. Joe River, would not protect faster growing Coeur d'Alene River cutthroat trout through one spawning period. Lewynsky (1986) indicated that only one-third to half of the cutthroat trout in his samples from the Coeur d'Alene River had actually spawned before reaching 330 mm. Overharvest of sexually immature cutthroat trout needs to be addressed in future management to ensure the viability of the fishery. We recommend implementation of a minimum length restriction on cutthroat trout in the Coeur d'Alene River to allow cutthroat trout to spawn once before they are harvested. The majority of first-time spawning cutthroat trout (age IV or less) in the Coeur d'Alene River drainage were smaller than 380 mm, and the mean length of spawning fish was 353 mm. A minimum length restriction of at least 355 mm should be implemented on the Coeur d'Alene River. However, a minimum length restriction of less than 400 mm may select against fish that initially spawn at age V. A minimum length restriction will result in catch and release of many undersized fish. Average cutthroat trout mortality from drift fishing with bait will be 40% (Hunsaker et al. 1970). We recommend a bag limit of one cutthroat trout to reduce mortality on immature fish and also allow a consumptive fishery.

Our sampling efforts coupled with the creel survey information indicate that Section 3 is an extremely important holding area for adult cutthroat trout. The high-yield, short-term nature of this fishery poses both social and biological problems. Anglers supported the implementation of a drainagewide management program involving more restrictive regulations to improve cutthroat trout fishing. Though a shortened fishing season was not supported by most anglers, a delayed season opening of July 1 would eliminate the large harvest of cutthroat trout in the lower Coeur d'Alene River during May and June. This action should provide angling opportunity for a longer duration for more anglers throughout the season.

Hatchery rainbow trout improved the trout catch rates in Section 1, the only release site within the study area. Using our estimated harvest and the known number of rainbow trout stocked, we calculated a 60% return to the angler during the survey. Movement was minimal because hatchery rainbow trout were rarely caught in the other two sections. Catchable rainbow trout should be distributed evenly throughout the lower Coeur d'Alene River to offset restrictions on cutthroat trout harvest. Kokanee

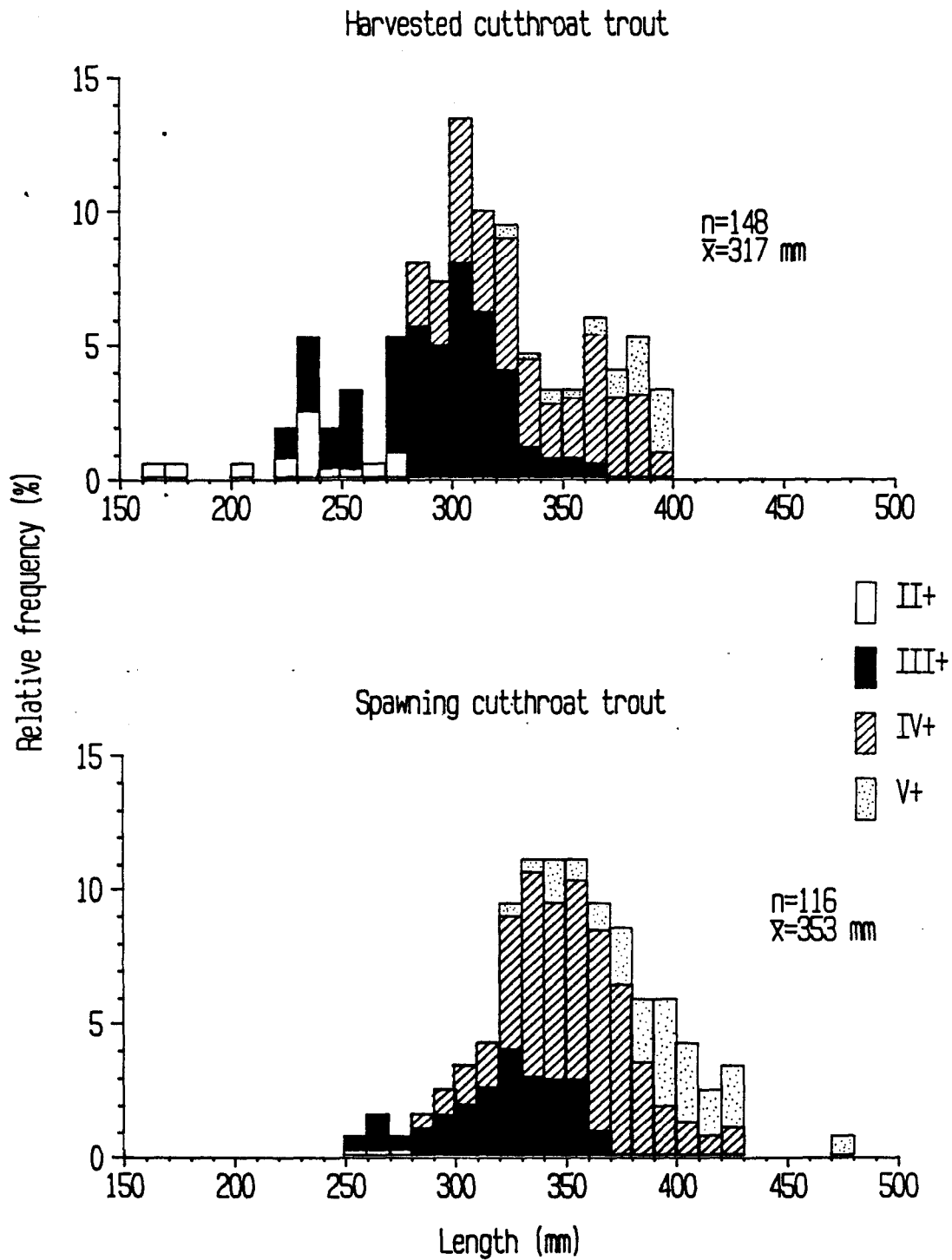


Figure 14. Age and length frequencies of harvested and spawning cutthroat trout in the Coeur d'Alene River, 1986.

salmon was the second most abundant species caught in sections 2 and 3, but anglers indicated that numbers have decreased dramatically in recent years. No quantitative data are available, but the decline may be associated with introductions of chinook salmon into Coeur d'Alene Lake (Horner et al. 1987).

Declining cutthroat trout populations in the St. Joe River prompted numerous past investigations. Rankel (1971) stated that unless mortality rates were reduced, it seemed likely that the stock would become economically if not biologically extinct. This led to implementation of special regulations (three trout $>13"$, 1973 through 1987) in the upper St. Joe River above Prospector Creek and tributary closures. The upper river has been a successful example of wild cutthroat trout management. From 1968 to 1975, cutthroat trout catch rates increased from 0.2 fish/h to 2.5 fish/h, and the percentage of fish in the catch longer than 250 mm increased from 2.5% to 18% (Mallet 1968; Thurow and Bjornn 1978).

Angler effort, catch rates, and harvest of westslope cutthroat trout on the lower river, under general regulations (six trout, only two $\geq 16"$), have increased since 1967 (Figure 15). The peak in harvest occurred in 1973, followed by a dramatic decrease in 1975 which Walch and Mauser (1976) attributed to late spring runoff, unfavorable weather conditions, and increased cost of fishing licenses.

Angler effort remained relatively constant in all sections throughout our survey on the lower river, though cutthroat trout catch and harvest rates declined dramatically. Anglers continued fishing in sections 2 and 3 despite declining catch rates. A small proportion of anglers, mostly families, continued to fish the slackwater reach in pursuit of species other than trout. By the end of the survey, cutthroat trout catch rates in Section 1 were also lower, but trout catch rates remained high relative to the other sections. Harvest of rainbow trout, stocked only in Section 1 and upstream, was responsible for the elevated catch rates. We estimated return to the creel of catchable rainbow trout was 50% for the St. Joe River in 1987.

The majority of the cutthroat trout harvest (78%) in all three sections of the St. Joe River occurred during Interval 1. The short-term nature of this fishery is a result of overexploitation and is influenced by movement of trout into and out of the upper river (governed by special regulations). Our tag recoveries and earlier work (Thurow and Bjornn 1978) indicate a distinct trend of cutthroat trout migration to the upper river (special regulation zone) during the spring to early summer and downstream migration in the fall. Consequently, the general regulation area below Avery is serving as a migrational corridor. Utilization of this area by cutthroat trout is limited by overharvest, lack of habitat (including high water temperatures), and the migratory nature of this stock. Jeppson (1960) found few "desirable game fish present in the lower St. Joe River during the summer months." His dynamite sampling from Avery downstream to St. Joe City during July produced no trout. Excluding catchable rainbow trout, trout and char comprised less than 1% of his sample in August and September.

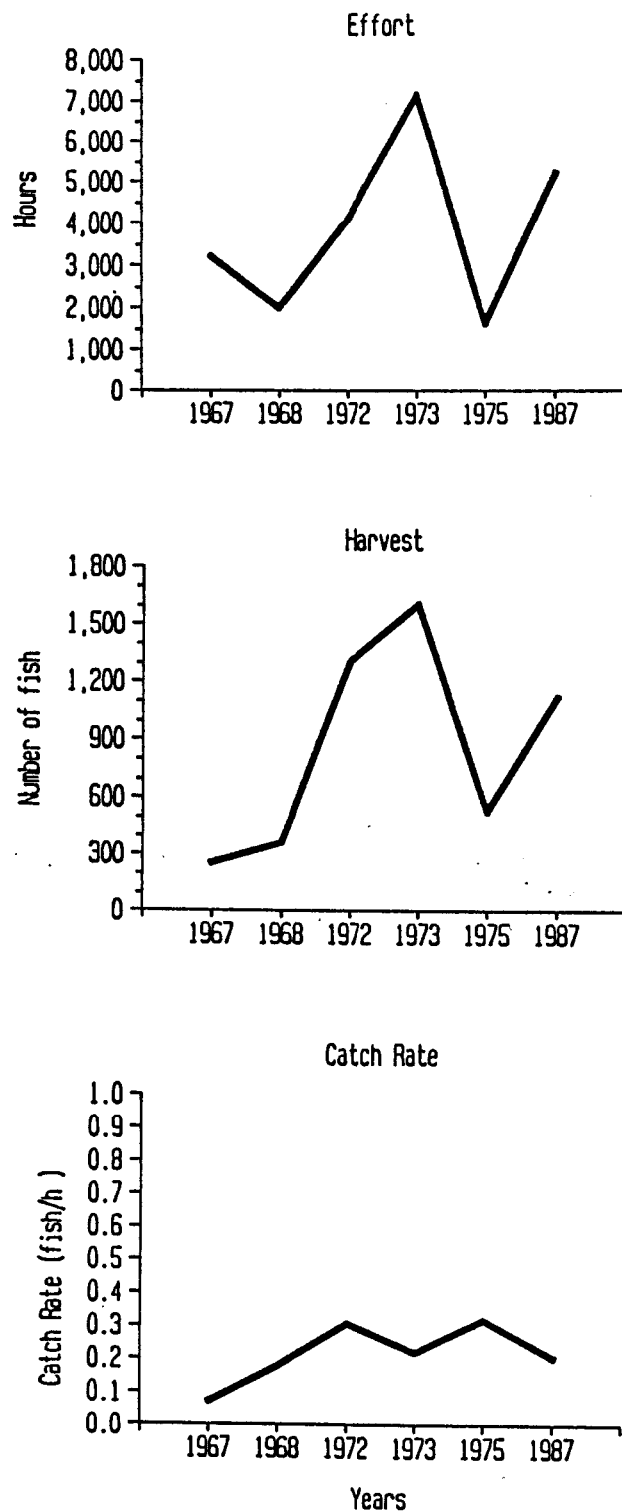


Figure 15. Estimates of angler effort, harvest of westslope cutthroat trout, and catch rate for the first five weeks of the season from Falls Creek to Avery, St. Joe River, 1967 through 1987 (Dunn 1968; Mallet 1968; Ortmann 1973; Goodnight and Mauser 1974; Walch and Mauser 1976).

During the 1987 survey, 81% of the cutthroat trout harvested in the lower river were longer than 250 mm. This indicates that larger cutthroat trout are being harvested in the spring as they migrate upstream through the general regulation area. Therefore, the only stocks protected by special regulations may be smaller fluvia and resident stocks. In 1985, only 10% of a sample of 326 cutthroat trout (caught between Conrad Crossing and Spruce Tree Campground, in the roaded section of special regulation water) were longer than 250 mm (Horner et al. 1987).

Past creel surveys on the St. Maries River have been limited to random checks by conservation officers and a partial survey conducted by Jeppson (1960) in 1959). Habitat degradation and extremely high water temperatures have plagued cutthroat trout populations from Clarkia downstream to St. Maries for several decades.

Out creel survey showed that cutthroat trout provided a short-term fishery in the St. Maries River with harvest decreasing to zero by the end of the survey. We observed 21°C water temperatures by July 1 in several locations from Clarkia downstream to St. Maries. Tagging, harvest, and temperature data indicate that the main river serves as a migration corridor for depressed populations of cutthroat trout. Small size and easy access make the St. Maries River cutthroat trout highly susceptible to overexploitation. This was evident in Section 1 where estimated return of catchable rainbow trout to the creel was 70%. The catchable program, limited to Section 1, was extremely popular with anglers, and catch rates above 1.0 trout/h were maintained throughout the survey. Section 2 had the highest cutthroat trout catch rates, and because of limited access, was used primarily by special interest anglers. Evidence suggests that this reach may be a congregating area for migrating adult cutthroat trout and should be monitored in the future.

Comparing the three rivers, 23 km of the Coeur d'Alene River received more effort, had a larger harvest, and produced larger cutthroat trout than 81 km and 49 km of the St. Joe and St. Maries rivers, respectively. Mean size of spawning cutthroat trout or size at onset of maturity were not determined from limited trapping data obtained in the St. Joe and St. Maries river drainages. Harvest of sexually immature cutthroat trout, however, poses a problem in all three drainages. We recommend the same harvest regulations be implemented in all three drainages studies.

Currently, successful fishing for cutthroat trout is restricted to the first of the season, and extended angling opportunity is dependent upon the catchable rainbow trout programs. Though the surveys were not conducted for the entire season, we observed minimal fishing pressure in areas with no rainbow trout supplementation until the fall (when cutthroat trout, responding to colder water temperatures moved back into the lower rivers). We recommend even distribution of catchable rainbow trout through mid-June throughout the lower St. Joe River. The St. Maries River is routinely stocked as often as is practical.

Bull trout populations are severely depressed in all three rivers. Our harvest and sampling information indicate bull trout status has remained consistent for many years (Jeppson 1960; Dunn 1968; Mallet 1968; Ortmann 1972; Goodnight and Mauser 1974; Walch and Mauser 196). We recommend a closure on bull trout harvest throughout the three drainages.

Northern squawfish populations in the St. Joe and St. Maries rivers have been intensively researched in past years. Social influence and concerns with interspecific competition and predation prompted numerous eradication programs. These programs were discontinued following treatments in 1973 and 1975 in the St. Maries and St. Joe rivers, respectively. We found that squawfish numbers are at or near population levels prior to treatment. A cursory investigation was made of stomach contents from approximately 350 northern squawfish during electrofish and gill net sampling. Sculpins, dace, crayfish, redbreasted shiners, insects, tench, yellow perch, and pumpkinseeds were identified as dominant prey of squawfish. No trout were found in squawfish stomachs, though juvenile trout were often found in the same locations. This compares with Falter's (1969) findings of no trout in stomachs of 449 squawfish collected from the lower St. Joe River. He attributed the lack of predation on trout by squawfish to habitat segregation of the two groups.

Bullhead and yellow perch, the dominant game fish we found in Slackwater of the St. Joe and St. Maries rivers, rarely exceeded 200 mm and 150 mm, respectively. Trout were physically limited from these reaches during summer by high water temperatures. One mountain whitefish was found over all sampling efforts. Evidently, species composition of the Slackwater has not changed over the last 40 years. "Hoopnetting from 1948 to 1951 showed tench, suckers, squawfish, brown bullheads, yellow perch, and common sunfish to comprise over 99% of fish in the slackwater portion of the two rivers" (Jeppson 1960).

Water temperatures in the main Coeur d'Alene River were not limiting to trout at anytime during the year. Although over 4,400 fish were caught with the Lake Merwin trap, it failed to catch any trout. We know that cutthroat and rainbow trout inhabit the lower river (Bauer 1975); therefore, we believe that trout avoided capture. Cutthroat trout have been observed avoiding similar traps in Priest Lake (Gregg Mauser, Idaho Department of Fish and Game, personal communication).

The Benewah Creek drainage is a major cutthroat trout producing system in the St. Joe River drainage, yet summer trout densities in mainstream Benewah Creek were relatively low. Lower Benewah Creek is an important nursery area for largemouth bass. A sparse sinner trout population may be attributed to high temperatures (17° to 19°C when snorkeling; 25°C maximum summer temperature), however cutthroat trout densities in Alder Creek (St. Maries River) and Evans Creek (Coeur d'Alene River) were higher at temperatures of 20.5 and 17.8°C, respectively. The dense overhanging cover in Alder and Evans creeks is probably effective thermal insulation by limiting the duration of extremely high water temperatures. Benewah Creek, as well as the North Fork Coeur d'Alene River and Johns Creek (St. Maries River) have sparse overhanging cover, allowing ambient air temperatures to quickly influence stream temperatures. Therefore, summer trout densities in tributary streams do not necessarily reflect total trout production if high summer temperatures force fry out of otherwise likely nursery areas, (Lewensky (1986) believed that cutthroat trout fry migrating from small tributaries reflected complete seeding of habitat, implying sufficient spawner escapement. We believe reasons for fry emigration may be more complex (i.e., due to limiting physical conditions). Unfortunately, we

trapped tributaries only during the spring. Several tributaries potentially important for cutthroat trout production were not trapped because it was logistically difficult. The downstream migrant traps in the St. Joe and St. Maries river tributaries caught mostly age I and II juvenile cutthroat trout, and movements typically peaked with freshets. Similarly, Rankel (1971) reported 682 of cutthroat trout migrated from St. Joe River tributaries at age II+, 17% at age I+, and 5% at age III+.

Contrary to what we expected, trout densities in two tributaries to the St. Joe River that had been closed to fishing for 14 years (Mica and Bond creeks) were exceptionally low. Only upper Trout Creek had higher than average cutthroat trout densities. Lower Reeds Gulch had very high brook trout densities, but no cutthroat trout. Thurow and Bjornn (1978) observed an overall increase in cutthroat trout densities during the initial years of the fishing closures on these streams. Upper Reeds Gulch remains a good producer of cutthroat trout. Mean density of age I and older cutthroat trout in the lower St. Joe tributaries was 8.3 fish per 100 m², compared to an average of 12 fish per 100 m² in upper river tributaries (Thurow and Bjornn 1978).

Cutthroat and rainbow trout densities in tributaries to the Coeur d'Alene River were comparable to densities in Pend Orielle and Priest river drainages (Pratt 1984; Cowley 1987; Irving 1987). With the exception of Trout, upper Alder, and Merry creeks, cutthroat and rainbow trout densities in tributaries to the St. Joe and St. Maries rivers were low. Only in Cougar Gulch, Brown, Willow, and Trout creeks did trout (cutthroat and rainbow) densities compare to the high densities (35 to 58 trout per 100 m²) found in Hayden Creek, Idaho (Gamblin. 1987). Very low densities of cutthroat-rainbow trout hybrids, reported in all three drainages were due, in part, to the difficulty of underwater identification.

Very few trout were jaw tagged in tributaries, except those fish caught by migratory traps. Extremely small numbers of fingerling-tagged juvenile trout were recaptured, probably a result of poor tag retention (Bill Horton, Idaho Department of Fish and Game, unpublished data). Recoveries of tagged trout in the St. Joe River drainage were limited, but a pattern of cutthroat trout movement was seen. Cutthroat trout were found downstream in fall and upstream in summer. Two cutthroat trout captured leaving Benewah Creek did show definite adfluvial movement. Half of the juvenile cutthroat trout tagged in tributaries in 1974 that did migrate into the river moved downstream and half moved upstream (Thurow and Bjornn 1978). Trout that rear in the tributaries to the lower St. Joe River and then migrate into the main river must either move downstream into the lake environment, or upstream to escape high summer water temperatures. Migratory stocks that spawn in Benewah Creek are definitely adfluvial because the creek flows directly into Benewah Lake and then through a lake complex into Lake Coeur d'Alene. Averett and MacPhee (1971) distinguished adfluvial from fluvial cutthroat trout by examining circuli and annuli patterns on scales. They observed cutthroat trout with evidence of lake growth in Benewah, Rochat, Trout, and Mica creeks in the St. Joe River drainage; and in Thorn Creek, the lowest tributary to the St. Maries

River. They also observed resident stocks of cutthroat trout in these streams. All that can be concluded about cutthroat trout populations in the St. Maries River drainage from our tagging data is that fluvial stocks exist. Thurow and Bjornn (1978) found that 892 of the cutthroat trout that migrated from tributaries to the river were tagged in the lower 5 km of the tributary. Johnson and Bjornn (1978) observed very little movement by cutthroat trout in the upper St. Joe River drainage after they established summer feeding stations. Our data suggest that the majority of cutthroat trout production in the St. Joe and St. Maries river drainages occurs further than 5 km upstream in tributaries. Adults were observed far upstream in several tributaries.

Lewynsky (1986) observed cutthroat trout aggregated in large pools in the Coeur d'Alene River during winter. This information, along with our evidence that cutthroat trout remain in the area between Cataldo and Dudley for substantial lengths of time, suggests that a large fluvial stock of cutthroat trout exists in the Coeur d'Alene River. Bauer (1975) cited the presence of spawning runs of cutthroat trout in Fourth of July Creek and in tributaries to Cave and Medicine lakes as evidence for adfluvial trout in the lower river system.

ACKNOWLEDGEMENTS

We thank Terry Elms-Cockrum, Jim Finlay, Duane Von Bargaen, Susan Ortega, Mike Rowe, Steve McNeill, and fish management personnel for their time and effort spent collecting and summarizing field data. Conservation Officers Bill Carter, Duane Lowry, and Doyle Reynolds helped with fieldwork. We give special thanks to Conservation Officer, Mark Hill, for assistance in the field, providing housing, and informing the public about the fishery and our research through his local newspaper column. We thank Joe Peak, owner of Enaville Resort, for collecting fish lengths and scale samples and Office Coordinator, Anna Marie Halpern, for typing our tables and appendices.

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A P P E N D I C E S

Appendix A. Mean length-at-age of cutthroat trout sampled from 1984 through 1986 in the lower Coeur d'Alene River drainage.

	Age class				
	1	2	3	4	5
Mean length at age (mm)	100	173	281	326	367
Increment of growth (mm)	100	73	108	45	41
Sample size	360	301	255	134	16
Standard deviation of length at age (mm)	21	42	33	31	34
Mean + 1 SD	(79-121)	(131-215)	(248-314)	(295-357)	(333-401)

Appendix B. Mean length-at-age of cutthroat trout in Benewah and Thorn creeks, 1986.

	Age class			
	1	2	3	4
Mean length at age (mm)	80	122	248	297
Increment of growth (mm)	80	42	126	49
Sample size	122	77	7	2
Standard deviation of length at age (mm)	12	23	30	13
Mean + 1 SD	(68-92)	(99-145)	(218-278)	(284-309)

Appendix C. Angler harvest (number of fish) by section and interval for the Coeur d'Alene over creel survey, 1986.

		Interval 1 (May 24 to June 6)							Total
		Cutthroat trout	CTT-RBT hybrid trout	Natural rainbow trout	Hatchery rainbow trout	Brook trout	Kokanee salmon	Bull trout	
Section 1	boat	29	5	0	34	0	0	0	68
	shore	167	28	0	195	0	0	0	390
Section 2	boat	11	1	0	0	0	0	0	12
	shore	107	10	0	0	0	0	0	117
Section 3	boat	820	18	7	7	18	36	0	906
	shore	106	15	6	6	15	60	0	208
Total	boat	860	24	7	41	18	36	0	986
	shore	380	53	6	201	15	60	0	715
		Interval 2 (June 7 to June 20)							Total
		Cutthroat trout	CTT-RBT hybrid trout	Natural rainbow trout	Hatchery rainbow trout	Brook trout	Kokanee salmon	Bull trout	
Section 1	boat	9	0	3	10	0	0	0	22
	shore	85	0	32	95	0	0	0	212
Section 2	boat	7	7	0	0	7	54	0	75
	shore	175	32	0	0	13	13	0	233
Section 3	boat	100	0		0	0	178	0	278
	shore	75	0		0	0	191	0	266
Total	boat	116	7	3	10	7	232	0	375
	shore	335	32	32	95	13	204	0	711
		Interval 3 (June 21 to June 30)							Total
		Cutthroat trout	CTT-RBT hybrid trout	Natural rainbow trout	Hatchery rainbow trout	Brook trout	Kokanee salmon	Bull trout	
Section 1	boat	15	0	7	7	0	0	0	29
	shore	31	0	16	16	0	0	0	63
Section 2	boat	0	2	0	0	2	24	0	28
	shore	0	13	0	0	13	189	0	215
Section 3	boat	4	0	4	4	0	0	0	12
	shore	26	0	26	26	0	0	0	78
Total	boat	19	2	11	11	2	24	0	69
	shore	57	13	42	42	13	189	0	356

Appendix D. Angler harvest (number of fish) by section and interval for the St. Joe River creel survey, 1987.

		Interval 1 (May 23 to June 5)							Total
		Cutthroat trout	CTT-RBT hybrid trout	Natural rainbow trout	Hatchery rainbow trout	Brook trout	Kokanee salmon	Bull trout	
Section 1 ^a	boat								
	shore	476	44	132	132	0	0	11	795
Section 2 ^a	boat								
	shore	400	35	61	44	0	0	8	548
Section 3	boat	220	0	0	0	0	0	0	220
	shore	215	0	0	20	0	0	0	235
Total	boat	220	0	0	0	0	0	0	220
	shore	1,091	79	193	196	0	0	19	1,578
		Interval 2 (June 6 to June 19)							
Section 1 ^a	boat	--	--	--	--	--	--	--	--
	shore	115	33	22	143	11	11	0	335
Section 2 ^a	boat	--	--	--	--	--	--	--	--
	shore	15	0	0	0	0	5	5	25
Section 3	boat	20	0	0	0	0	19	19	58
	shore	29	0	0	0	0	0	0	29
Total	boat	20	0	0	0	0	19	19	58
	shore	159	33	22	143	11	16	5	389
		Interval 3 (June 20 to June 26)							
Section 1 ^a	boat	--	--	--	--	--	--	--	--
	shore	86	0	17	69	0	0	17	189
Section 2 ^a	boat							--	
	shore	30	0	0	0	0	0	0	30
Section 3	boat	0	0	0	0	0	0	0	0
	shore	67	0	0	0	0	0	0	67
Total	boat	0	0	0	0	0	0	0	0
	shore	183	0	17	69	0	0	17	286

^aBoat harvest included with shore harvest.

Appendix E. Angler harvest (number of fish) by section and interval for the St. Maries River creel survey, 1987.

		Interval 1 (May 23 to June 5)							Total
		Cutthroat trout	CTT-RBT hybrid trout	Natural rainbow trout	Hatchery rainbow trout	Brook trout	Kokanee salmon	Bull trout	
Section 1 ^a	boat shore	180	12	12	180	0	0	0	384
Section 2 ^a	boat shore	-- 78	-- 2	-- 0	 2	0	0	0	82
Section 3	boat shore	0 22	0 0	0 0	0 0	0 0	0 0	0 0	0 22
Total	boat shore	0 280	0 14	0 12	0 182	0 0	0 0	0 0	0 488
		Interval 2 (June 6 to June 19)							Total
Section 1 ^a	boat shore	-- 15	-- 0	-- 0	-- 0	-- 0	-- 5	-- 5	-- 25
Section 2 ^a	boat shore	20	0	0	0	0	0	0	20
Section 3	boat shore	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Total	boat shore	0 167	0 0	0 0	0 626	0 0	0 0	0 0	0 793
		Interval 3 (June 20 to June 26)							Total
Section 1 ^a	boat shore	-- 0	-- 0	-- 0	-- 340	-- 0	-- 0	-- 12	-- 352
Section 2 ^a	boat shore	-- 0	-- 0	-- 0	-- 0	-- 0	-- 0	-- 0	-- 0
Section 3	boat shore	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Total	boat shore	0 0	0 0	0 0	0 340	0 0	0 0	0 12	0 352

^aBoat harvest included with shore harvest.

Appendix F. Number (n), mean total length (mm) (\bar{x}), and range of lengths () of salmonids collected by drift boat electrofishing in the Coeur d'Alene, St. Joe, and St. Maries rivers, 1986 and 1987.

Stream	Date	Temp (°C)	River section ^a	Effort (h)	CTT		RBT		HYB		BKT		BLT		MWF		KOK	
					n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}
Coeur d'Alene River	May 1, 22 1986	10.7	1	12	29 (118-375)	291	3 (270-335)	303	2 (120-328)	224	6 (150-451)	235	0 --	--	29 (115-324)	173	0	--
	June 17 1986	--	2	5.5	5 (160-295)	200	19 (107-480)	255	2 (111-204)	158	0 --	--	0 --	--	121 (142-440)	239	18 (210-258)	221
	June 18 1986	18	1	7	14 (109-415)	212	1 --	528	3 (135-149)	144	26 (148-225)	189	0 --	--	98 (135-249)	168	51 (112-254)	204
	July 1 1986	18	1	7	19 (152-400)	270	10 (165-309)	223	3 (166-425)	254	12 (165-340)	214	0 --	--	6 (154-228)	186	36 (135-255)	221
	October 13 1986	9.5	1	6.5	13 (220-464)	328	12 (214-326)	273	2 (212-362)	287	18 (120-298)	219	0		0	--	0	--
St. Joe River	August 13 1986	24	3	7	0		1	396	0		0		0 --	--	118 (101-375)	284	0	
	August 20 1986	21	4	6	0 --	--	2 (263-402)	333	0		0		0 --	--	48 (137-386)	274	0	
	October 23 1986	6	3	6.5	14 (223-382)	301	7 (213-420)	324	0		0		0 --	--	124 (132-355)	275	0	
	October 24 1986	6	4	6	7 (244-385)	323	3 ' (230-347)	306	0		0 --	--	2 (476-527)	502	106 (252-357)	301	0	

Appendix F, continued.

Stream	Date	Temp (°C)	River section ^a	Effort (h)	CTT		RBT		HYB		BKT		BLT		MWF		KOK	
					n	R	n	R	n	R	n	R	n	R	n	R	n	R
St. Maries River	May 5 1987	--	5	5	4	271	3	212	2	192	0	--	0	--	63	236	0	-
					(166-345)		(147-270)		(186-198)				--		(140-310)		--	
	May 20 1987	6	5	5	12	217	2	226	2	141	0	--	0	--	58	232	0	-
					(137-310)		(200-252)		(106-175)		--		--		(48-309)		--	

- ^a1: Coeur d'Alene River from the South Fork to Cataldo Mission (12.5 km).
2: Coeur d'Alene River from the Little North Fork to the South Fork (7.1 km).
3: St. Joe River from Moose Creek to Falls Creek (9.7 km).
4: St. Joe River from Huckleberry Campground to Moose Creek (9.7 km).
5: St. Maries River from the Middle Fork, to Metropolitan Bridge (6.8 km).

Key:

- CTT = cutthroat trout
RBT = rainbow trout
HYB = rainbow-cutthroat hybrid trout
BKT = brook trout
BLT = bull trout
MWF = mountain whitefish
KOK = kokanee salmon

Appendix G. Fish captured in a Lake Merwin trap located near the mouth of Coeur d'Alene River, 1984.

Date	Bullhead	Tench	Pumpkinseeds	Kokanee	Northern squawfish	Other ^a
June 29	26	17	6	- 6	3	4
30	32	7	32	50	1	10
July 1	125	13	10	14	1	0
2	132	5	29	8	4	3
3	436	27	39	2	4	10
4	496	36	5	0	2	6
5	383	41	13	0	4	3
6	9	36	6	0	0	2
7	253	20	18	0	9	7
8	345	25	10	0	11	6
9	94	8	7	0	3	6
10	4	8	11	0	1	2
11	23	17	12	0		4
12	4	14	22	0	0	12
13	23	8	9	0	0	3
14	0	7	6	0	0	5
15	43	18	14	0	8	16
16	879	32	12	2	24	8
17	15	20	8	1	5	5
Total	3,322	359	269	83	80	112
Percent	78.6	8.5	6.4	2.0	1.9	2.6

^aIncludes black crappie, yellow perch, sucker species, largemouth bass, redbreast shiners, and northern pike.

Appendix G-a. Fish captured in a Lake Merwin trap located in the Coeur d'Alene River at Bull Run Lake Bridge, 1985.

Date	Bullhead	Tench	Pumpkinseeds	Kokanee	Northern squawfish	Yellow perch
July 9	3	3	0	0	1	1
10	0	6	2	1	0	1
11	0	4	0	0	0	0
12	0	3	0	0	2	0
13	0	2	0	0	0	0
14	0	6	0	0	0	0
15	12	7	0	0	0	0
16	0	5	0	0	2	0
17	0	4	0	0	0	0
18	0	6	0	0	0	0
19	34	17	0	0	1	0
20	0	9	0	0	0	0
21	3	13	0	0	0	0
22	2	11	0	0	1	0
23	8	5	0	0	1	0
24	0	5	0	0	0	0
25	0	1	0	0	0	0
26	0	1	0	0	0	0
27	6	6	0	0	0	0
28	21	13	0	0	0	1
29	0	6	0	0	0	0
30	0	0	0	0	0	0
31	0	0	0	0	0	0
Total	89	133	2	1	8	3
Percent	38	56	1	1	3	1

Appendix H. Number (n), mean total length (mm) (\bar{x}), and range of lengths () of fish species captured by gillnetting in the St. Joe and St. Maries rivers, 1987.

Date	Location ^a	Effort (h)	Water temp. (°C)	NS		SKR		BBH		MWF		PS		LMB		Tench		YP		BCR	
				n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}
June 19	1 ^b	12.0	16.0	2	--	9	--	41	151 (114-260)	0	--	0	--	0	--	0	--	0	--	0	--
June 19	1 ^c	12.0	16.0	7	--	0	--	7	--	0	--	2	--	0	--	0	--	0	--	0	--
June 19	2 ^b	11.0	18.0	7	--	26	--	2	191 (142-210)	0	--	0	--	0	--	0	--	1	210	0	--
June 19	2 ^c	11.0	18.0	20	-- (?-573)	0	--	1	--	0	--	0	--	0	--	0	--	1	--	0	--
June 19	3 ^b	16.0	21.0	17	--	32	--	4	--	0	--	0	--	0	--	0	--	2	170 (150-190)	1	--
June 19	3 ^c	16.0	21.0	24	331 (195-540) ^d	1	--	0	--	0	--	0	--	1	--	3	--	1	--	0	--
July 23	1 ^b	10.5	21	3	309 (255-390)	6	297 (215-347)	17	150 (130-210)	1	250	1	--	0	--	0	--	0	--	0	--
July 23	1 ^c	10.5	21	2	286 (285-286)	1	168	1	150 (137-160)	0	--	0	--	1	144	0	--	0	--	0	--
July 23	2 ^b	14.0	21.5	9	277 (195-350)	26	269 (182-380)	7	153 (130-178)	0	--	0	--	0	--	2	280 (260-300)	1	172	0	--
July 23	2 ^c	14.0	21.5	12	254 (186-437)	4	182 (170-200)	1	--	0	--	0	--	0	--	0	--	0	--	1	--
July 23	3 ^b	16.0	21.5	15	254	2	240 (230-249)	10	159 (144-190)	0	--	1	119	2	161 (140-182)	1	395	1	200	0	--

Appendix H, continued.

Date	Location ^a	Effort (h)	Water temp. (°C)	NS		SKR		BBH		MWF		PS		LMB		Tench		YP		BCR	
				n	x	n	x	n	x	n	x	n	x	n	x	n	x	n	x	n	x
July 23	3 ^c	16.0	21.5	11	249 (206-356)	2	241 (207-275)	5	157 (140-190)	0	--	0	--	0	--	0	--	3	161 (150-168)	1	109 --
Aug 28	1 ^b	10.5	20.0	2	296 (293-298)	12	314 (227-395)	33	150 (121-198)	0	--	0	--	0	--	0	--	0	--	1	115 --
Aug 28	1 ^c	10.5	20.0	2	271 (257-284)	3	221 (172-247)	17	148 (135-194)	0	--	2	94 (89-99)	0	--	0	--	0	--	0	--
Aug 28	2 ^b	13.5	20.0	11	291 (195-393)	36	283 (123-491)	7	176 (142-229)	0	--	2	111 (97-124)	0	--	0	--	1	144 --	2	135 (112-158)
Aug 28	2 ^c	13.5	20.0	8	248 (187-295)	0	--	3	152 (142-173)	0	--	0	--	0	--	0	--	2	154 (150-157)	0	--
Aug 28	3 ^b	16.0	20.0	5	362 (267-473)	27	322 (198-488)	12	156 (140-185)	0	--	3	97 (96-99)	5	276 (157-355)	2	252 (149-355)	0	--	0	--
Aug 28	3 ^c	16.0	20.0	9	350 (274-425)	1	344 --	0	--	0	--	1	97 --	0	--	0	--	10	152 --	0	--
Dec 11	1 ^b	19.0	3.0	1	505 --	6	434 (421-460)	0	--	0	--	0	--	0	--	0	--	0	--	0	--
Dec 11	1 ^c	19.0	3.0	0	--	0	--	0	--	0	--	0	--	0	--	0	--	0	--	0	--
Dec 11	2 ^b	16.0	3.0	1	349 --	1	370 --	0	--	0	--	0	--	0	--	0	--	0	--	0	--
Dec 11	2 ^c	16.0	3.0	1	90 --	0	--	0	--	0	--	0	--	0	--	0	--	0	--	0	--

Appendix H, continued.

Date	Location ^a	Effort (h)	Water temp. (°C)	NS		SKR		BBH		MWF		PS		LMB		Tench		YP		BCR	
				n	̄x	n	̄x	n	̄x	n	̄x	n	̄x	n	̄x	n	̄x	n	̄x	n	̄x
Dec 11	4 ^b	16.0	3.0	3	367	38	397	0	--	0	--	0	--	0	--	0	--	1	139	0	--
				(340-382)		(230-505)		--		--		--		--		--		--		--	
Dec 11	4 ^c	16	3.0	1	260	0	--	0	--	0	--	0	--	0	--	0	--	0	--	0	--
				--		--		--		--		--		--		--		--		--	

^a1: St. Joe River - 3.1 km upstream from confluence with St. Maries River.

2: St. Joe River - 6.4 km downstream from confluence with St. Maries River.

3: St. Maries River - 2.7 km upstream from confluence with St. Joe River.

4: St. Joe River - 0.3 km upstream from confluence with St. Maries River.

^bSinking net.

^cFloating net.

^dMean length and range calculated for all squawfish captured on June 19.

Key:

NS = northern squawfish
 SKR = sucker species
 BBH = bullhead species
 MWF = mountain whitefish
 PS = pumpkinseeds
 LMB = largemouth bass
 YP = yellow perch
 BCR = black crappie

Appendix I. Number (n), mean total length (mm) (\bar{x}), and range of lengths () of fish species captured by electrofishing in slackwater reaches of the St. Joe and St. Maries rivers, 1987.

Date	Location ^a	NS		SKR		BBH		PS		LMB		Tench		YP		BCR		RSS	
		n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}	n	\bar{x}
June 29	1	14	242 (104-445)	13	320 (187-524)	8	126 (98-156)	0	-- --	0	-- --	0	-- --	7	106 (94-114)	0	-- --	1	100 --
June 29	2	9	255 (105-469)	12	357 (194-479)	9	159 (121-268)	1	89 --	0	-- --	0	-- --	23	117 (79-137)	0	-- --	1	108 --
June 29	3	3	154 (110-180)	4	212 (136-253)	2	129 (125-132)	0	-- --	0	-- --	0	-- --	9	102 (82-123)	1	108 --	0	-- --
July 28	1	18	207 (111-370)	16	337 (142-536)	9	144 (105-174)	0	-- --	0	-- --	1	362 --	7	110 (82-120)	0	-- --	0	-- --
July 28	2	21	207 (121-339)	16	312 (171-538)	8	141 (115-166)	0	-- --	0	-- --	2	292 (284-299)	25	112 (77-154)	0	-- --	0	-- --
July 28	3	29	186 (128-287)	29	243 (130-393)	36	137 (97-179)	0	-- --	11	266 (64-448)	1	228 --	41	114 (90-150)	0	-- --	0	-- --
August 31	1	24	234 (136-420)	35	289 (179-516)	21	135 (104-178)	2	94 (92-96)	1	56 --	0	-- --	73	117 (90-149)	0	-- --	0	-- --
August 31	2	14	226 (132-380)	67	326 (155-480)	26	164 (113-263)	0	-- --	4	85 (58-153)	4	351 (274-395)	35	119 (98-157)	0	-- --	0	-- --
August 31	3	25	205 (122-338)	25	265 (117-421)	20	155 (128-175)	3	91 (80-112)	6	168 (70-431)	0	-- --	38	120 (90-164)	6	163 (124-241)	0	-- --

^a1: St. Joe River 3.1 km upstream from confluence with St. Maries River.

2: St. Joe River 6.4 km downstream from confluence with St. Maries River.

3: St. Maries River 2.7 km upstream from confluence with St. Joe River.

Key: NS = northern squawfish
SKR = suckers

BBH = bullhead species
PS = pumpkinseeds

LMB = largemouth bass
YP = yellow perch

BCR = black crappie
RSS = redbside shiners

R9FR5AH

R9FR5AH

Appendix J. Relative abundance (%), mean total length (mm) (\bar{x}), and range of lengths () of trout and char captured by electrofishing in tributaries to the Coeur d'Alene, St. Joe, and St. Maries rivers, 1984 through 1987.

Stream	Cutthroat trout		Rainbow trout		Hybrid RBT-CTT		Brook trout		Bull trout	
	%	\bar{x} TL	%	\bar{x} TL	%	\bar{x} TL	%	\bar{x} TL	%	\bar{x} TL
Coeur d'Alene River										
Bear Cr.	45	128 (34-214)	8	226 (173-280)	0	-- --	48	99 (52-221)	0	-- --
Blue Lake Cr.	14	104 (37-155)	0	-- --	0	-- --	86	127 (51-314)	0	-- --
Cottonwood Cr.	100	116 (24-236)	0	-- --	0	-- --	0	-- --	0	-- --
Brown Cr.	49	109 (30-210)	25	112 (41-178)	20	101 (33-166)	4	141 (109-195)	1	202 --
Bumblebee Cr.	54	102 (25-180)	12	128 (103-220)	2	117 --	32	113 (36-245)	0	-- --
Canyon Cr.	100	139 (126-155)	0	-- --	0	-- --	0	-- --	0	-- --
Clark Cr.	100	157 (43-252)	0	-- --	0	-- --	0	-- --	0	-- --
Coal Cr.	87	127 (100-148)	0	-- --	13	109 --	0	-- --	0	-- --
Copper Cr.	39	110 (81-245)	20	131 (50-235)	3	150 (110-226)	38	149 (42-323)	0	-- --
Cougar Gulch	48	117 (28-216)	22	71 (32-108)	24	102 (85-142)	6	88 (68-94)	0	-- --
Eagle Cr.	73	145 (105-185)	0	-- --	0	-- --	27	181 (131-250)	0	-- --
W. Fk. Eagle Cr.	77	121 (32-234)	0	-- --	0	-- --	23	134 (79-255)	0	-- --
E. Fk. Eagle Cr.	33	150 (92-209)	0	-- --	0	-- --	67	144 (105-205)	0	-- --
Evans Cr.	98	124 (35-363)	0	-- --	1	167 --	1	212 --	0	-- --

Appendix J, continued.

Stream	Cutthroat trout		Rainbow trout		Hybrid RBT-CTT		Brook trout		Bull trout	
	%	xTL	%	xTL	%	xTL	%	xTL	%	xTL
Coeur d'Alene River (cont.)										
Fortier Cr.	66	109	0	--	0	--	34	84	0	--
	(40-214)		--		--		(53-176)		--	
Fourth of July Cr.	81	134	0	--	0	--	19	81	0	--
	(37-227)		--		--		(48-176)		--	
French Gulch	97	102	1	--	1	--	1	--	0	--
	(35-245)		--		--		--		--	
Graham Cr.	17	151	18	140	4	122	57	155	3	194
	(81-230)		(76-267)		(82-160)		(43-300)		(174-211)	
Grizzly Cr.	73	130	21	125	4	106	1	150	0	--
	(44-237)		(95-233)		(95-117)		--		--	
Hecla Channel	74	150	20	223	4	111	2	120	0	--
	(35-281)		(90-295)		(89-270)		(64-258)		--	
Hunt Gulch	91	91	0	--	0	--	9	147	0	--
	(46-345)		--		--		(120-162)		--	
Latour Cr.	70	121	0	--	0	--	30	103	0	--
	(59-213)		--		--		(62-189)		--	
Little Teepee Cr.	0	--	0	--	0	--	100	137	0	--
	--		--		--		(115-187)		--	
Lost Cr. (includes E. Fk. Lost Cr. & Hat Cr.)	58	144	10	115	20	124	11	156	0	--
	(69-254)		(49-254)		(78-231)		(96-250)		--	
E. Fk. Pine Cr.	57	148	0	--	0	--	43	144	0	--
	(112-183)		--		--		(122-183)		--	
Trapper Cr.	93	133	0	--	0	--	7	69	0	--
	(95-159)		--		--		--		--	
Robinson Cr.	100	107	0	--	0	--	0	--	0	--
	(41-231)		--		--		--		--	
Rose Cr.	100	110	0	--	0	--	0	--	0	--
	(43-195)		--		--		--		--	

Appendix J, continued.

Stream	Cutthroat trout		Rainbow trout		Hybrid RBT-CTT		Brook trout		Bull trout	
	%	xTL	%	xTL	%	xTL	%	xTL	%	xTL
Coeur d'Alene River (cont.)										
Scott Cr.	77	88	15	115	8	139	0	--	0	--
	(30-152)		(93-136)		--		--		--	
Skeel Gulch	100	172	0	--	0	--	0	--	0	--
	(45-395)		--		--		--		--	
Steamboat Cr.	60	123	14	125	26	123	0	--	0	--
	(35-245)		(115-135)		(105-185)		--		--	
Thompson Cr.	81	87	0	--	0	--	19	128	0	--
	(34-227)		--		--		(60-227)		--	
Willow Cr.	100	120	0	--	0	--	0	--	0	--
	(41-239)		--		--		--		--	
St. Joe River										
Benewah Cr.	72	104	0	--	1	124	27	123	0	--
	(35-205)		--		(116-132)		(45-285)		--	
Bond Cr.	70	135	0	--	0	--	30	182	0	--
	(68-249)		--		--		(70-300)		--	
Cherry Cr.	99	97	0	--	1	--	0	--	0	--
	(31-212)		--		--		--		--	
Falls Cr.	61	122	0	--	0	--	39	135	0	--
	(43-225)		--		--		(68-251)		--	
Hugus Cr.	46	112	0	--	0	--	54	128	0	--
	(56-194)		--		--		(62-205)		--	
Mica Cr.	30	164	0	--	6	181	63	143	<1	245
	(43-307)		--		(133-282)		(38-368)		--	
Moose Cr.	61	106	0	--	0	--	39	122	0	--
	(31-191)		--		--		(43-174)		--	
Reeds Gulch	0	--	0	--	0	--	100	161	0	--
	--		--		--		(41-293)		--	
Rochat Cr.	14	152	0	--	0	--	86	120	0	--
	(38-253)		--		--		(45-250)		--	

Appendix J, continued.

trout	Cutthroat		Rainbow trout		Hybrid RBT-CTT		Brook trout		Bull trout	
Stream	%	xTL	%	xTL	%	xTL	%	xTL	%	xTL
St. Joe River (cont.)										
Street Cr.	25	135	0	--	1	150	74	124	0	--
	(56-228)		--		(124-176)		(43-264)		--	
Thomas Cr.	71	110	0	--	0	--	28	138	1	197
	(34-214)		--		--		(59-249)		--	
Trout Cr.	76	120	1	120	7	147	15	163	1	272
	(55-385)		--		(98-238)		(66-255)		--	
St. Maries River										
Alder Cr.	71	120	0	--	0	--	29	169	0	--
	(52-372)		--		--		(69-310)		--	
Beaver Cr.	41	99	0	--	0	--	59	103	0	--
	(35-230)		--		--		(35-248)		--	
Blair Cr.	100	122	0	--	0	--	0	--	0	--
	(90-156)		--		--		--		--	
Carlin Cr.	100	110	0	--	0	--	0	--	0	--
	(62-153)		--		--		--		--	
Carpenter Cr.	46	156	0	--	0	--	54	190	0	--
	(36-268)		--		--		(114-280)		--	
Cats Spur Cr.	96	113	0	--	0	--	4	121	0	--
	(39-212)		--		--		(73-169)		--	
Kitten Cr.	100	104	0	--	0	--	0	--	0	--
	(71-149)		--		--		--		--	
Childs Cr.	100	149	0	--	0	--	0	--	0	--
	(83-246)		--		--		--		--	
Crystal Cr.	6	161	0	--	0	--	94	118	0	--
	(51-217)		--		--		(41-323)		--	
Flat Cr.	98	84	0	--	0	--	2	41	0	--
	(33-175)		--		--		--		--	
Merry Cr.	100	122	0	--	0	--	0	--	0	--
	(34-215)		--		--		--		--	

Appendix J, continued.

Stream	Cutthroat trout		Rainbow trout		Hybrid RBT-CTT		Brook trout		Bull trout	
	%	xTL	%	xTL	%	xTL	%	xTL	%	xTL
St. Maries River (cont.)										
W. Fk. Merry Cr.	100	136	0	--	0	-	0	--	0	--
	(72-236)		--		--		--		--	
Mann Cr.	100	119	0	--	0	--	0	--	0	--
	(81-179)		--		--		--		--	
Olson Cr.	44	180	11	194	0	--	44	145	0	--
	(106-266)		(177-211)		--		(58-226)		--	
Renfro Cr. ^a	80	118	3	267	0	--	11	110	0	--
	(36-264)		(254-280)		--		(53-162)		--	
Davis Cr.	19	110	0	--	0	--	81	121	0	--
	(56-157)		--		--		(46-250)		--	
Santa Cr.	100	135	0	--	0	--	0	--	0	--
	(114-231)		--		--		--		--	
Charlie Cr.	41	130	0	--	0	--	59	126	0	--
	(62-122)		--		--		(58-195)		--	
Hume Cr.	100	116	0	--	0	--	0	--	0	--
	(44-174)		--		--		--		--	
Sheep Cr.	150	177	0	--	0	--	0	--	0	--
	(143-205)		--		--		--		--	
Soldier Cr.	100	65	0	--	0	--	0	--	0	--
	(35-145)		--		--		--		--	
Thorn Cr.	96	130	0	--	2	145	2	200	0	--
	(50-215)		--		--		--		--	
Canyon Cr.	100	130	0	--	0	--	0	--	0	--
	(38-203)		--		--		--		--	

^aMountain whitefish comprised 6% of all salmonids in Renfro Creek.

Appendix K. Electrofishing effort (s) and salmonid catch composition (numbers) for tributaries to the Coeur d'Alene, St. Joe, and St. Maries rivers, 1984 through 1987.

Stream	Site	Transect location (T,R,Sec.)	Date	water temp (C)	Time (s)	Number of trout				
						Cutthroat	Hybrid		Brook	Bull
							Rainbow	RBT-CTT		
Coeur d'Alene River										
Bear Cr.	1	49N,2E,27,28,29	07-22-85	14.0	538	18	3	0	19	0
Blue lake Cr.	1	48N,3W,14	07-09-85	15.0	399	3	0	0	48	0
Cottonwood Cr.	1	48N,3W,12	06-20-85	12.0	837	45	0	0	0	0
Brown Cr.	1	50N,3E,23	08-06-85	11.0	190	3	9	4	0	1
	2	50N,3E,SW1/4,11	08-06-85	9.0	341	6	1	8	1	0
Bumblebee Cr.	2	50N,1E,25,36	07-23-85	14.5	1252	35	8	1	21	0
Canyon Cr.	1	50N,1E,7	08-14-84	12.0		3	0	0	0	0
Clark Cr.	1	48N,2W,27	08-02-84	16.5	1205	60	0	0	0	0
Coal Cr.	1	50N,3E,30	08-02-85	16.5	180	1		0	0	0
Copper Cr.		50N,1E,SE1/4,30	07-24-85	18.0	291	12	17	0	11	0
Cougar Gulch	1	50N,2E,34	07-19-85	14.5	500	12	6	12	2	0
Eagle Cr.	1	50N,4E,26	08-12-85	12.0	1000	8	0	0	3	0
W. Fk. Eagle Cr.	1	50N,4E,13	08-12-85	12.0	890	37	0	0	7	0
	2	50N,5E,SW1/4,7	08-15-85	10.0	550	9	0	0	9	0
	3	50N,5E,SW1/4,4	08-15-85	10.0	144	7	0	0	0	0
E. Fk. Eagle Cr.	1	50N,5E,19	08-12-85	12.0	397	8	0	0	3	0
	2	50N,5E,SE1/4,16	08-15-85	12.5	259	2	0	0	17	0
Evans Cr.	1	47N,2W,3	07-10-85	15.0	654	23	0	1	1	0
	2	47N,2W,11	07-10-85	15.0	660	29	0		0	0
Fortier Cr.	1	48N,2W,3	08-22-85	12.0	480	86	0	0	44	0
Fourth of July Cr.	1	49N,1W,22,27	07-11-85	10.0	688	39	0	0	9	0
French Gulch	1	48N,1E,SE1/4,1	07-18-85	16.0	317	36	0	0	0	0
Graham Cr.	1	50N,3E,33	07-31-85	11.0	800	11	10	3	46	2

Appendix K, continued.

Transect location Stream	Site	Water	Time (T,R,Sec.)	Date	Hybrid		Number of trout				
		tomp (T,R,Sec.)			(C)	(s)	Cutthroat	Rainbow	RBT-CTT	Brook	Bull
Coeur d'Alene River (cont.)											
Grizzly Cr.	1		50N,3E,22	08-06-85	11.0	496	29	6	1	0	0
Heccla Channel	1 ^a		48N,5E,35,36	08-29-84	9.5	--	335	88	17	11	0
Hunt Gulch	1		49N,1E,35	04-15-85	12.0	--	32	0	0	3	0
Latour Cr.	1		48N,1E,5	09-05-84	18.0	--	31	0	0	9	0
	2		48N,1W,14	09-06-84	12.0	--	44	0	0	30	0
	3		48N,1W,23	09-05-84	14.0	--	20	0	0	1	0
	4		47N,1W,3	09-05-84	11.0	--	1	0	0	0	0
Little Teepee Cr.	1		49N,1E,4	08-09-84	12.0	159	0	0	0	6	0
Lost Cr.	1		50N,4E,4,9	08-20-85	10.5	595	0	5	1	0	0
	2		51N,4E,NE1/4,34	07-25-85	11.0	636	27	1	0	5	0
	3		51N,4E,NW1/4,26	07-26-85	10.0	820	64	0	0	19	0
E. Fk. Lost Cr.	1		50N,4E,3	07-24-85	10.5	656	10	7	20	1	0
Hat Cr.	1		51N,4E,34	07-24-85	10.5	300	14	0	3	0	0
E. Fk. Pine Cr.	1		48N,2E,34	09-04-84	14.5	--	0	0	0	6	0
	2		47N,2E,2	09-04-84	11.5	--	8	0	0	0	0
Trapper Cr.	1		48N,2E,33	09-04-84	13.0	--	14	0	0	1	0
Robinson Cr.	1		48N,2W,NW1/4,25	08-06-84	10.0	405	97	0	0	0	0
Rose Cr.	1		49N,1W,NW1/4,32	07-15-85	16.0	483	30	0	0	0	0
Scott Cr.	1		50N,2E,SW1/4,24	08-07-85	10.0	359	10	2	1	0	0
Skeel Gulch	1		48N,1E,SE1/4,4	08-13-85	12.0	358	20		0	0	0
Steamboat Cr.	1		50N,2E,NW1/4,11	08-05-85	10.0	300	3	4	9	0	0
W Fk Steamboat Cr.	1		50N,2E,NE1/4,4	08-05-85	10.5	1000	6	2	2	0	0
E Fk Steamboat Cr.	1		51N,2E,NW1/4,34	08-05-85	10.0	800	10	0	0	0	0
Thompson Cr.	1		48N,3W,15	07-09-85	17.0	459	35	0	0	5	0
Willow Cr.	1		47N,2W,SE1/4,4	07-10-85	20.0	343	26	0	0	0	0

Appendix K, continued.

Stream	Site	Transect location (T,R,Sec.)	Date	water temp (C)	Time (s)	Number of trout				
						Cutthroat	Rainbow	Hybrid RBT-CTT	Brook	Bull
St. Joe River										
Benewah Cr.	1	46N,3W,14	07-10-86	16.0	3181	17	0	0	0	0
	2	46N,3W,22,23	07-15-86	12.0	1187	15	0	1	0	0
	3	46N,3W,27	07-14-86	21.0	552	22	0	2	0	0
	4	46N,3W,27	07-15-86	20.0	951	15	0	0	0	0
	5 ^b	45N,3W,8,18	07-16-86	12.0	468	12	0	0	0	0
	6 ^c	45N,3W,17,18	07-16-86	11.0	843	67	0	0	0	0
	7	45N,4W,NW1/4,24	07-16-86	12.0	1356	18	0	0	0	0
	8 ^d	45N,4W,SE1/4,23	07-17-86	10.0	386	4	0	0	21	0
	9 ^e	45N,4W,24,25	07-17-86	11.0	475	27	0	0	17	0
	10	45N,4W,NE1/4,26	08-07-86	13.5	2000	48	0	0	28	0
	11	45N,4W,NW1/4,26	08-07-86	17.0	200	11	0	0	0	0
Bond Cr.	1	46N,1E,27,28,34	08-20-86	17.0	3325	56	0	0	27	0
Cherry Cr.	1	46N,2W,20	07-10-86	13.0	1519	128	0	1	0	0
.Falls Cr.	1	46N,1E,23	09-18-86	9.0	257	18	0	0	A6	0
	2	46N,1E,2	09-18-86	9.0	401	56	0	0	31	0
Hugus Cr.	1	45N,2E,6	09-18-86	10.0	881	29	0	0	34	0
Mica Cr.	1	45N,3E,NW1/4,7	07-31-86	12.0	3333	34	0	15	1	1
	2	45N,2E,33	08-06-86	20.0	2061	40	0	0	155	0
Moose Cr.	1	45N,2E,4,9	08-13-86	10.0	721	46	0	0	29	0
Reeds Gulch	1	46N,1E,NE1/4,19	08-06-86	12.0	100	0	0	0	19	0
Rochat Cr.	1	46N,1W,15	08-13-87	11.0	830	0	0	0	109	0
	2	46N,1W,SW1/4,10	08-13-87	11.0	576	21	0	0	24	0
Street Cr.	I ^f	46N,1W,5,8	07-30-86	11.0	1992	48	0	2	142	0
Thomas Cr.	1	46N,2W,12	07-29-86	13.0	1800	67	0	0	27	1
Trout Cr.	1	46N,2E,29,31	09-17-86	12.0	1710	87	1	8	17	1

Appendix K, continued.

Stream	Site	Transect location (T,R,Sec.)	Date	Water temp (C)	Time (s)	Number of trout					
						Cutthroat	Rainbow	Hybrid		Brook	Bull
								RBT-CTT			
St. Maries River											
Alder Cr.	1	45N,2W,NE1/4,31,32	08-19-86	16.0	2000	75	0	0	21	0	
	2	45N,3W,35,NE1/4,36	08-18-86	21.0	2703	138	0	0	67	0	
Beaver Cr.	1	44N,1W,9	07-09-87	14.0	1169	41	0	0	58	0	
Blair Cr.	1	43N,1E,25	07-07-87	14.0	425	8	0	0	0	0	
Carlin Cr.	1	45N,2W,19	07-21-86	16.0	1885	50	0	0	0	0	
Carpenter Cr.	1	43N,1W,24	08-11-86	20.0	2000	12	0	0	14	0	
Cat Spur	1	42N,2E,SE 1/4 19	08-20-87	15.0	772	13	0	0	1	0	
	2	42N,2E,NE1/4,29	08-20-87	14.5	548	40	0	0	1	0	
Kitten Cr.		42N,2E,SW1/4,28	08-20-87	10.0	548	9	0	0	0	0	
Childs Cr.	1	43N,1E,15	08-05-87	11.0	1063	19	0	0	0	0	
Crystal Cr.	1	44N,1W,36	08-13-87	11.5	489	0		0	35	0	
	2	44N,1E,30	08-13-87	11.5	604	0	0	0	74	0	
	3	44N,1W,20	08-20-87	10.0	773	8	0	0	18	0	
Flat Cr.	1	45N,2W,36	07-09-87	11.0	1180	45	0	0	1	0	
Merry Cr.	1	43N,2E,SW1/4,33	07-08-87	15.0	912	22	0	0	0	0	
	2	43N,2E,14	07-08-87	15.0	449	31	0	0	0	0	
W. Fk. Merry Cr.	1	43N,2E,33	07-08-87	14.0	1185	25	0	0	0	0	
	2	43N,2E,29	07-08-87	13.0	641	10	0	0	0	0	
Mann Cr.	1	43N,2E,NE1/4,23	07-08-87	14.5	274	8	0	0	0	0	
Olson Cr.	1	43N,1E,9	08-05-87	13.0	940	8	2	0	8	0	
Renfro Cr.	1	44N,1W,22	08-05-87	18.0	957	37	2	0	0	0	
	2	44N,1W,NE1/4,13	08-05-87	13.0	374	7	0	0	3	0	
	3	44N,1E,4,9	08-04-87	15.5	603	3	0	0	4	0	
	4 ^g	44N,1E,18	08-04-87	14.0	250	5	0	0	0	0	

Appendix K, continued.

Stream	Site	Transect location (T,R,Sec.)	Date	Water temp (C)	Time (s)	Cutthroat	Number of trout			
							Rainbow	Hybrid RBT-CTT	Brook	Bull
St. Maries River (cont.										
Davis Cr.	1	44N,1W,12	08-04-87	16.0	500	8	0	0	17	0
	2	44N,1W,12	08-04-87	16.0	500	3	0	0	31	0
Santa Cr.	1	44N,1W,18	08-12-86	19.0	1000	0	0	0	0	0
	2	44N,2W,23,24	08-12-86	19.0	500	3	0	0	0	0
	3	44N,2W,22	08-12-86	21.0	500	1	0	0	0	0
	4	44N,2W,32	08-12-86	23.0	1000	0	0	0	0	0
Charlie Cr.	1	44N,2W,SE1/4,33	08-12-86	21.0	900	8	0	0	0	0
	2	43N,2W,NW1/4,15	08-12-86	16.0	318	3	0	0	16	0
Hume Cr.	1	43N,2W,9	08-12-86	13.0	200	5	0	0	0	0
Sheep Cr.	1	44N,1W,27	08-05-87	19.0	220	0	0	0	0	0
	2	44N,1W,28	08-05-87	16.0	421	16	0	0	0	0
soldier Cr.	1	44N,1W,5	07-09-87	12.0	379	49	0	0	0	0
Thorn Cr.	1	46N,2W,36	07-23-86	17.0	1045	37	0	1	1	0
	2	45N,1W,NE1/4,16,10	07-22-86	20.0	711	21	0	0	0	0
Canyon Cr.	1	46N,1W,31,32	07-22-86	14.0	244	18	0	0	0	0
	2	45N,1W,3	07-22-86	14.0	1715	87	0	0	0	0

^aTwelve pools created by manmade, drop-log structures were surveyed.

^bSurveyed small triutary called Whitetail Draw (below main road).

^cSurveyed small tributary that we named Producer Creek.

^dSurveyed small tributary below the main road.

^eSurveyed small tributary that flows adjacent to Benewah schoolhouse.

^fSurveyed above and below intermittent section.

^gSurveyed small tributary from mouth upstream.

JOB COMPLETION REPORT

State of: Idaho

Name: RIVER AND STREAM INVESTIGATIONS

Project No.: F-73-R-10

Title: North Idaho Streams Fishery Research

Subproject No.: IV

Study No.: IV

Job No.: 2.Fish Habitat Description

Period Covered: March 1, 1987 to February 29, 1988

ABSTRACT

A fisheries habitat evaluation methodology developed by personnel from the U.S. Forest Service, Idaho Panhandle National Forest, was used to survey streams on the lower Coeur d'Alene, lower St. Joe, and St. Maries rivers. Parameters included stream order, elevation, gradient, valley bottom and channel type, temperature, habitat type, cover components, and spawning sites. Use of this stream survey system will allow comparison of habitat in 45 study streams with many other streams surveyed by Forest Service and Department personnel throughout northern Idaho.. Habitat quality is related to fish density and species composition (refer to Job I) in individual streams. Needs for habitat improvements are discussed for specific streams.

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INTRODUCTION

An integral component of fish population assessment is some definition of the physical parameters of the fishes' environment. To assess the stream habitat, a cost effective, time efficient, and simple inventory survey was needed to meet project objectives. Habitat degradation from road building, timber harvest, agricultural practices, stream encroachment, mining, and very high natural discharges have occurred in recent years throughout the Coeur d'Alene, St. Joe, and St. Maries river drainages. Baseline habitat information is needed to provide a relative index from which managers can readily assess stream potential for responses to land-use proposals, instream water uses, proposed changes in regulations, and fishery enhancement. In 1985, the habitat survey method used by the primary land manager in northern Idaho, the U.S. Forest Service, was selected to evaluate the fish habitat in our study streams. This method was developed by Idaho Panhandle National Forest personnel over the last seven years and used on several drainages in north Idaho (E. Linder and R. Rainville, U.S. Forest Service, unpublished data). Their work is a modification of stream survey methods described by Duff and Cooper (1978).

Limited habitat surveys have been conducted in the past on tributaries to the Coeur d'Alene River (Bauer 1975) and the St. Joe and St. Maries rivers (Ringe et al. 1978).

OBJECTIVES

To evaluate fish habitat and identify factors which may limit production of salmonids in the lower Coeur d'Alene, the lower St. Joe, and the St. Maries river systems.

RECOMMENDATIONS

Information contained in this manuscript should be used as a database to monitor future stream alterations and to guide habitat improvement efforts where such efforts may be most effective. Priority for habitat improvements is given to those streams with good potential for increased trout production, especially migratory cutthroat trout.

First priority should be to protect streams that currently provide adequate habitat and adequate trout production. The following tributaries in the lower Coeur d'Alene River (below the North Fork) produce migratory cutthroat trout: French Gulch, Skeel Gulch, Latour Creek, Cougar Gulch, and Graham Creek. In the lower St. Joe River, they include: Benewah Creek and tributaries, Cherry, Thomas, Bond, Trout, and Mica creeks. In the St. Maries River, they include: Alder, Carlin, Thorn, Flat, Soldier, Merry, Renfro, Cat Spur, and Charlie creeks (refer to Job I, Figures 2, 3,

and 4). Streams that support good resident trout fisheries and should be protected are: Cougar Gulch, Latour, Copper, Pine, and Graham creeks in the Coeur d'Alene River drainage; Cherry, Street, Falls, Reeds Gulch, upper Trout, and upper Mica creeks in the St. Joe River drainage; and Canyon, Alder, Beaver, Crystal, upper Sheep, Renfro, Davis, upper Carpenter, Childs, and Merry creeks in the St. Maries River drainage.

Instream cover should be enhanced by addition of large organic matter in the following streams (listed by priority for each drainage); French Gulch, Brown Creek, Cougar Gulch, and Skeel Gulch (Coeur d'Alene River); Bond, Trout, Mica, Street, Thomas, and Benewah creeks (St. Joe River); and Alder, Flat, Soldier, Carlin, Renfro, Thorn, Olson, Merry, Charlie, and John creeks (St. Maries River). Improvements are also needed in the Middle Fork St. Maries River and mainstem St. Maries River.

Cattle exclosures on several streams would allow revegetation and stabilization of the streambank, provide increased overhanging cover, buffer high summer temperatures, and add to the productivity of the streams. Severely degraded sections in the following streams, listed by priority, should be fenced from livestock: French Gulch, Evans Creek, Blue Lake Creek, Skeel Gulch, and Willow Creek (Coeur d'Alene River); Benewah Creek including several tributaries, Bond Creek, Mica Creek, Street Creek, and Reeds Gulch (St. Joe River); and Renfro, Charlie, Olson, Thorn, Canyon, and John creeks, Middle Fork, mainstem, West Fork St. Maries River, and Merry Creek (St. Maries River).

Enhancement efforts aimed specifically at improving instream and overhanging cover for holding and rearing fish will consequentially improve spawning habitat. Removal of a partial bedrock barrier on Alder Creek and replacement of highway culverts on Coal and Scott creeks should be considered to improve migratory trout passage.

METHODS

Stream reaches were first identified on U.S. Geological Survey 7.5 minute topographic maps, or 15 minute maps when the larger scale maps were not available. A more refined delineation was done on-site if necessary when the stream was surveyed. A reach was defined as a section of stream which had the same potential for biological production and physical alteration. A stream reach had similar gradient, valley bottom, discharge, and was at least 0.4 km long.

Information was recorded on survey maps and standard survey forms (Appendix A). Stream reaches, fish migration barriers, sediment sources (slumps, slides, etc.), channel braiding, dry stream channel sections, and actual segments surveyed were marked on maps. The survey form was used to record the following information: valley bottom type, channel type, stream order, temperature, habitat type, gradient, spawning sites, pool creators, spawning site creators, and cover components. All information was later transferred to the U.S. Forest Service Data General Computer for analysis and summarization.

Habitat types fell within defined physical characteristics classified as pool, riffle, run, or pocketwater. Pools were divided into four classes using depth, cover, and area factors (Class 1 pool = highest quality). Cover (large organic material, boulders, undercut banks, and overhanging vegetation) was measured and expressed as percentages in all habitat types except riffles.

Stream gradients were measured on-site using a clinometer. All distance measurements were made in English units. Specific criteria for classifying streams and habitat types appear in Appendix B.

In 1985 and 1986, distances between transects were determined randomly. A random number of feet was measured upstream to each successive transect, then the entire continuous area of the habitat type that the transect fell into was measured. In 1987, a systematic method was used to measure distances to survey transects. Each transect was 25 ft upstream from the previous transect. Only the first 5 ft of the habitat type was measured.

Water temperature extremes were measured at several locations in the rivers and tributaries. Minimum/maximum thermometers were placed in the streams in June and removed in August and September. Summer water temperatures higher than 19°C were considered limiting to trout.

RESULTS

Table 1 summarizes habitat conditions for streams that were surveyed in 1985 through 1987. Percentages of habitat types in each stream reach are displayed graphically in Appendix C. More detailed habitat summaries are given in Appendix D. The computer summarized data for habitat components, pool creators, spawning site creators, and stream cover percentages. This information is filed but not included in this report.

Minimum/maximum water temperatures appear in Appendix E. Conductivities for Coeur d'Alene River tributaries measured during electrofishing sampling appear in Appendix F.

DISCUSSION

Habitat evaluations and fish density evaluations were primarily conducted on identical stream sections. Therefore, we can make inferences regarding the relationships between habitat quality-quantity and fish populations in the tributaries that were studied.

In the field, we observed a positive relationship between good cover components (particularly large organic material) in pools and high trout densities throughout all three river systems. The relationship between cover and fish densities has been observed by several other researchers (Chapman and Bjornn 1969; Bustard and Narver 1975; Bryant 1983; Dolloff 1983; Elliot 1986; Heifetz et al. 1986; Gamblin 1987). When instream cover

Table 1. Summary of habitat, fisheries quality, and human activity in tributaries to the Coeur d'Alene, St. Joe, and St. Maries rivers, 1984 through 1987.

Drainage & stream	Habitat quality	Fisheries	Human activity
St. Joe River			
Benewah Cr. ^a (lower) 4.4 km	No spawning; moderate instream cover; cascading/ large boulder; high summer temperatures of long duration	Lowest 0.6 km serves as nursery area for YOY largemouth bass; high cutthroat trout production in small tributaries; mainstem serves as migration corridor only; nongame fish abundant	Roaded, but is 0.4 km above stream
Benewah Cr. ^a (middle)	No spawning; moderate instream cover; sparse riparian; meandering pool/run; high summer temperatures of long duration	Same as lower section	Roaded; severe bank erosion caused by cattle grazing; impacts caused by several streamside residences
Benewah Cr. ^a (upper)	Spawning gravels abundant; sedimentation problems; moderate instream cover; meandering pool/run; high summer temperatures	Good cutthroat trout production; high fry densities; all brook trout found in this section; cutthroat trout primarily migratory	Roaded; manmade barrier 16 km from mouth; grazing; impacts caused by several streamside residences
Bond Cr. (lower) 2.4 km	Spawning gravels abundant; no instream cover; high summer temperatures of long duration; straight riffle/run; no riparian	Trout production limited by grazing impacts; juvenile squawfish and other nongame species abundant; migratory cutthroat trout present	Roaded; heavily grazed; rechanneled
Bond Cr. (upper)	Good spawning; moderate instream cover; good riparian, shading 1/2 of stream; good riffle/run/pool complex	Low trout production considering long-term closure; cutthroat trout production primarily migratory	Road network accesses headwaters of all major tributaries and follows Bond Cr. at a distance; recent logging in headwaters of mainstem and tributaries
Cherry Cr. (lower) 3.2 km	Extreme lower 0.8 km is slackwater; sedimented, but good spawning gravels above slackwater; good riparian; good instream cover; good riffle/run/pool complex	Warmwater game fish in slackwater; good resident cutthroat trout production; limited migratory cutthroat trout	Channelized near mouth; light grazing, stream fenced from livestock; roaded

Table 1, continued.

Drainage & stream	Habitat quality	Fisheries	Human activity
St. Joe River (cont.)			
Cherry Cr. b,c (upper)	Poor spawning; cascading/ large boulder; conifer canopy	Unknown	Roaded; severe impacts from residences along stream
Falls Cr. ^b	Bedrock barrier at mouth; good spawning; good instream cover; good riparian	Strictly resident trout; both cutthroat and brook trout	Roaded; active, heavy logging
Hugus Cr.	Good spawning; good instream cover; good riparian; high summer temperatures	Apparently poor trout production	Roaded; active and heavy logging throughout drainage
Mica Cr. (lower) 10 km	Spawning present, gravels large; low instream cover; shaded by conifer canopy; short-term high temperature limitations; good pool/ riffle/run complex	Diverse trout composition; low numbers of trout; limited production of migratory cutthroat trout	Lower 10 km unroaded; several residences at mouth
Mica Cr. (upper)	Good spawning; moderate instream cover; low gradient meadow environment; high proportion riffles; sedimentation problem	Good cutthroat and brook trout production; migratory cutthroat trout present	Roaded; severe livestock impacts; current heavy logging
Moose Cr. ^b	Summer subterranean flow for 0.2 km near mouth; high beaver activity at mouth; moderate spawning; moderate instream cover; good riparian cover	Brook trout only at mouth; cutthroat trout dominate above subterranean flow; resident fishery	Unroaded; light livestock activity; recent logging
Reeds Gulch (lower) 1.5 km	Summer subterranean flow for 0.8 km just above highway; instream cover primarily <i>fontinalis</i> and undercut bank; excellent spawning; meadow environment; patchy riparian	Dominated by brook trout; good production	Roaded; past channelization; current and historic logging; heavy grazing; several residences; gravel quarry reason for channelization

Table 1, continued.

Drainage & stream	Habitat quality	Fisheries	Human activity
St. Joe River (cont.)			
Reeds Gulch ^{b,c} (upper)	Good spawning; good instream cover; good riparian; good pool/riffle/run complex	Cursory snorkeling, observed only cutthroat trout; probable resident population	Unroaded
Rochat Cr. (lower) 1.5 km	Good spawning; moderate instream cover; good riparian; dominated by riffle/run; stream below dam is created by ground-water recharge only	Dominated by brook trout; good production; cutthroat trout probably resident population	Dewatered 1.5 km above mouth by concrete dam; provides water for town of St. Maries; private road
Rochat Cr. ^{b,c} (upper)	Good habitat observed upstream from diversion	Assume good resident cutthroat trout population; numerous cutthroat trout just above diversion; not sampled	Unroaded
Street Cr. ^b (lower) 1.5 km	Good spawning; no riparian; instream cover primarily <u>fontinalis</u> ; summer subterranean flow for 0.4 km beginning 0.8 km from mouth	Dominated by brook trout	First 0.8 km roaded; • heavily grazed; historic logging; (cause for subterranean flow)
Street Cr. (upper)	Good spawning; good riparian; moderate instream cover; good pool/riffle/run	Cutthroat trout primarily resident population; equal proportions of cutthroat and brook trout	Unroaded; historically logged
Thomas Cr.	Good spawning; riparian shades entire stream; high summer temperatures buffered by riparian; good instream cover	Dominated by cutthroat trout	Unroaded; grazing near mouth, but stream is fenced from livestock; historic logging
Trout Cr. ^a (lower) 1.6 km	Good spawning; low instream cover; low riparian; high proportion of riffles; erosion from past high discharge	Dominated by cutthroat trout, used by adults during summer; migratory cutthroat trout production	Roaded; rechanneled; several residences at mouth

Table 1, continued.

Drainage & stream	Habitat quality	Fisheries	Human activity
St. Joe River (cont.)			
Trout Cr. ^b (upper)	Good spawning; completely shaded by conifer canopy; meadow environment at headwaters; good instream cover	Dominated by cutthroat trout; good trout production	Unroaded except at headwaters; historic logging;
Whittenburg Draw ^{b,c}	Good spawning; good riparian; low instream cover; high proportion of riffles; partial barrier at hwy. culvert		
St. Maries River			
Alder Cr. ^a (lower) 5 km	Poor spawning; boulders provide only instream cover; stream shaded by conifer canopy; primarily riffle/run complex; bedrock waterfall at upper end; navigable only at high discharge	Limited trout production; migratory cutthroat trout present (several large adults observed in pool below falls during spring)	Unmaintained road lower 1.5 km; recent logging
Alder Cr. ^a (upper)	Good spawning; good instream cover; good riparian; good pool/riffle/run complex; high quality pools; limiting high summer temperatures of short duration; unsurveyed tributaries appeared to be important for trout production	Good trout production; primary area for migratory cutthroat trout production (several large adults observed during summer)	Roaded; several residences; light grazing; recent logging; North Fork has been severely impacted
Beaver Cr.	High beaver activity at mouth hindering fish passage; good spawning; moderate instream cover (primarily overhanging vegetation); good riparian shades half of stream; good pool/riffle/run complex	Mouth dominated by nongame species; equal proportions of cutthroat and brook trout; questionable migratory production	Roaded; limited grazing; past logging

Table 1, continued.

Drainage & stream	Habitat quality	Fisheries	Human activity
St. Maries River (cont.)			
Blair Cr. ^b	Heavily sedimented; poor overall habitat quality; primarily riffle/run complex	Low trout densities; only cutthroat trout observed; low trout production potential	Roaded at headwaters; heavy current logging at headwaters
Carlin Cr. ^a	Limited spawning; good instream cover; good riparian; heavy beaver activity in headwaters; high proportion pocket water; small manmade dam near mouth creates barrier at low discharge	Migratory cutthroat trout production; no brook trout observed	Roaded; recent logging
Carpenter Cr. ^b	Heavily sedimented; good instream cover; riparian primarily brush; heavy beaver activity; extremely high water turbidity	Equal proportions of cutthroat and brook trout; primarily resident population; inventory of lower stream prevented by turbidity	Heavy current and past emerald mining, with associated channelizations; numerous residences; heavy recent logging in headwaters; moderate grazing
Childs Cr. ^b	Good spawning; good riparian; good instream cover	Resident cutthroat trout population above dam; no brook trout present	Roaded; current logging; permanent concrete dam 0.4 km from mouth
Crystal Cr. (lower) 5 km	Heavily sedimented; sparse brush riparian; moderate instream cover; good riffle/run/pool complex, some meadow environment; partial barriers at hwy. culvert and mouth; high beaver activity; man-related poor water quality	Dominated by brook trout; no cutthroat trout observed	Roaded; numerous small sawmill; current logging; light grazing
Flat Cr. ^a	Limited spawning gravels; summer flow limitations; good riparian shading stream; good instream cover	Dominated by cutthroat trout, primarily migratory population (apparent efficient use of limited spawning gravels)	Moderate grazing; unmaintained road at mouth; past logging

Table 1, continued.

Drainage & stream	Habitat quality	Fisheries	Human activity
St. Maries River (cont.)			
John Cr. ^b	Very limited spawning; cascading, high proportion of boulders below water-fall barrier 1 km above mouth; low riparian and instream cover above barrier; meadow reach with limiting summer temperatures	Resident brook trout and cutthroat trout populations; low trout densities	Unmaintained road at mouth; heavily roaded at headwaters; current and past logging; heavy grazing
Merry Cr. ^a (lower)	Heavily sedimented; limited spawning gravels; brush riparian; moderate instream cover; high proportion riffle/run complex; limiting high summer temperatures <u>West Fork</u> : similar to lower section of mainstem	Dominated by cutthroat trout; migratory cutthroat trout present <u>West Fork</u> : limited production of cutthroat trout; dominated by cutthroat trout	Roaded; heavily logged; light grazing <u>West Fork</u> : similar to lower section of mainstem
Merry Cr. ^a (upper)	Abundant spawning gravels, but sedimentation problems; good instream cover; brush riparian; good pool/riffle/run complex; limiting summer temperatures <u>Mann Cr.</u> ^b : heavy beaver activity at mouth; primarily meadow; heavily sedimented	Major production of cutthroat trout for entire drainage occurs here; migratory cutthroat trout present <u>Mann Cr.</u> : dominated by cutthroat trout; limited trout production	Roaded; heavy past and current logging; light grazing <u>Mann Cr.</u> : similar to upper section of Merry Cr.
Olson Cr. ^b (lower) 0.8 km	Heavily sedimented; limited spawning; sparse riparian; meadow; low instream cover; primarily riffle/run complex	Low densities of cutthroat, rainbow, and brook trout; no trout production observed; apparently used by trout avoiding high water temperatures in river	Moderate grazing
Olson Cr. ^c (upper)	Fair spawning; moderate sedimentation; stream completely shaded by forest canopy; moderate instream cover; riffle/run/pocket water complex	Limited production of cutthroat and brook trout	Roaded; recent logging

Table 1, continued.

Drainage & _ stream	Habitat quality	Fisheries	Human activity
St. Maries River (cont.)			
Renfro Cr. (lower) 4 km	Limited spawning; moderate sedimentation; good instream cover; sparse brush riparian; meadow; primarily run/riffle; trout using drop-log structures near mouth just above hwy. <u>Davis Cr.^b</u> : limited spawning; summer temperature and flow limitations; low instream cover; sparse brush riparian	Cutthroat and rainbow trout present; apparently used by trout produced upstream and by trout avoiding high water temperatures in river; migratory cutthroat trout production <u>Davis Cr.</u> : primarily brook trout; possibly limited migratory production of cutthroat trout	Roaded; impacts by several residences; moderate grazing; recent logging; drop-log structures placed by property owners <u>Davis Cr.</u> : similar to lower Renfro Creek
Renfro Cr. (upper)	Good spawning; good riparian; good instream cover; good pool/riffle/run complex; stream completely shaded by forest canopy	Low densities of cutthroat and brook trout (not representative of the habitat)	Roaded; several residences; moderate grazing; recent logging
Santa Cr.	Limited spawning; heavily sedimented; poor instream cover; sparse brush riparian; primarily meadow environment dominated by long pools; severe bank erosion; summer temperature limitation of long duration; fish barrier at low discharge 3 km from mouth; high turbidity <u>Charlie Cr. (lower 2.4 km)</u> : fair spawning; moderate sedimentation; sparse riparian; summer temperature limitations; low instream cover; long meandering pools with short riffles; moderate turbidity <u>Charlie Cr.^b (upper)</u> : good spawning; good instream cover; good brush riparian; good pool/riffle/run complex	Abundance of nongame fish; possibly serves as migration corridor for cutthroat trout; local residents report large runs of adult cutthroat trout in the past <u>Charlie Cr. (lower)</u> : similar to Santa Creek; limited production of cutthroat trout <u>Charlie Cr. (upper)</u> : low densities of cutthroat and brook trout; possible migratory cutthroat trout production	Severe water quality problems from numerous residences along stream and town of Emida; heavy grazing; current logging; operating rock quarry 3 km from mouth' blamed for fish kills in mid-1970s and currently could still pose upstream migration problems <u>Charlie Cr. (lower)</u> : heavy grazing; roaded <u>Charlie Cr. (upper)</u> : roaded; light grazing; current logging

Table 1, continued.

Drainage & stream	Habitat quality	Fisheries	Human activity
St. Maries River (cont.)			
Sheep Cr. ^b (lower) 3.2 km	No spawning; poor overall habitat; summer flow and temperature limitations; meadow; high turbidity	No trout; redbside shiners abundant	Heavy grazing; recent logging; water quality problems related to residences; roaded
Sheep Cr. ^b (upper)	Fair spawning; good instream cover; good brush riparian; good riffle/run/pool complex; summer flow limitations	Resident cutthroat trout production	Moderate grazing; recent logging; roaded
Soldier Cr. ^{a, b}	Fair spawning (road gravel apparently used); poor instream cover; brush riparian shades most of stream; primarily riffle/run complex; limiting summer flows	Migratory cutthroat trout population indicated by abundance of young fish and absence of fish older than 1+	Roaded; recent logging
Thorn Cr. ^a (lower) 2.4 km	Limited spawning; moderate instream cover; sparse brush riparian; primarily riffle/run complex in upper end; lower 0.4 km influenced by slackwater in river; lower 0.4 km impacted by high discharge events; summer temperature limitation	Diverse game fish composition; apparent nursery area for largemouth bass; dominated by cutthroat trout; migratory population of cutthroat trout present	Roaded; moderate grazing (stream fenced); recent logging
Thorn Cr. ^a (upper)	Limited spawning; poor instream cover (primarily boulders); headwaters with large debris jams; brush riparian with forest canopy shading half of stream; summer temperatures limiting; abundant runs and pocket water	Dominated by cutthroat trout; low trout densities; migratory and resident populations	Roaded; heavy recent logging; moderate grazing
	<u>Canyon Cr.:</u> good spawning; moderate instream cover; headwaters primarily meadow environment; hwy. culvert at mouth only navigable at high discharge	<u>Canyon Cr.:</u> dominated by cutthroat trout; high trout densities; primarily resident populations	<u>Canyon Cr.:</u> roaded; past and current logging; moderate grazing in meadow area

Drainage &

Table 1, continued.

Drainage & stream	Habitat quality	Fisheries	Human activity
St. Maries River (cont.)			
W. Fk. St. Maries River ^{a,b} (lower) 4.8 km	Limited spawning; poor instream cover; no riparian; summer temperatures limiting; primarily pool/riffle complex Cat Spur Cr. ^{a,b} : moderate beaver activity; abundant spawning gravels; moderate sediment; moderate instream cover; meadow environment in lower section with conifer canopy in headwaters; good pool/riffle/run complex	Dominated by nongame species; mainstem serves as migration corridor only for cutthroat trout Cat Spur Cr.: dominated by cutthroat trout; major production of cutthroat trout for entire drainage occurs here; migratory cutthroat trout present; local residents report large runs of adult cutthroat trout in past years	Roaded; heavy grazing; past logging Cat Spur Cr.: roaded; moderate grazing; current and past logging
W. Fk. St. Maries River ^b (upper)	Moderate spawning and instream cover; small pool/run complex; forest canopy; brush riparian	Dominated by cutthroat trout; several potentially important tributary streams	Roaded; light grazing; current and past logging
Coeur d'Alene River			
Bear Cr.	Good spawning; poor instream cover; sparse riparian; good pool/riffle/run complex; passage barrier at mouth at low water	Moderate densities of cutthroat, brook and domesticated Kamloops trout	Roaded; heavy mining activity; old mill log ponds creating barrier at mouth; private pond rearing of Kamloops trout; severe impacts by residents; channelization; historic logging
Blue Lake Cr. ^b (lower) 3 km	Good spawning gravels; good pool/riffle/run complex; sparse riparian; no instream cover; summer subterranean flow	Abundant brook trout	Roaded; heavily grazed; private and fenced; guest ranch operation; historically logged; extends to Forest Service boundary

stream	Habitat quality	Fisheries	Human activity
Coeur d'Alene River (cont.)			
Blue Lake Cr. ^{b,c} (upper)	Spawning gravels present, but summer subterranean flow in lower end limits survival; brush riparian <u>Cottonwood Cr.:</u> good spawning; good instream cover; conifer canopy shades majority of stream	Unknown <u>Cottonwood Cr.:</u> cutthroat trout present; high density of fry; apparent migratory population	Roaded; past logging <u>Cottonwood Cr.:</u> roaded; current logging
Brown Cr. ^d	Good spawning gravel; moderate instream cover; high proportion of riffles; forest canopy with brush riparian	Diverse trout community; rainbow, and cutthroat migratory populations; low densities of brook and bull trout	Roaded; past logging
Bumblebee Cr. ^b (lower)	Low gradient; good spawning; braided channel; primarily riffle/run; poor instream cover; moderate brush riparian	Low densities of cutthroat, rainbow and brook trout; primarily resident populations	Roaded; one campground; recent logging
Bumblebee Cr. ^b (upper)	Poor spawning; cascading; primarily large boulder instream cover; moderate riparian; upper and lower sections separated by road culvert forming partial navigation barrier	Same as lower section	Roaded; recent logging
Canyon Cr. ^b	Limited spawning; dense riparian; high gradient cascading stream	Low densities of cutthroat trout; resident populations only	Past logging
Clark Cr. ^{b,c} (lower)	Poor spawning; low instream cover; sparse riparian; surrounded by pasture; canal network at lower 1.6 km	Cutthroat trout present; primarily resident population	Grazing; channelization; historic logging; roaded
Clark Cr. ^b (upper)	Moderate spawning; brush riparian with forest canopy	Cutthroat trout present; primarily resident population; reproduction occurring	Roaded; historic logging

Table 1, continued.
Drainage &

stream	Habitat quality	Fisheries	Human activity
Coeur d'Alene River (cont.)			
Coal Cr.	Limited spawning (pockets of gravel); poor instream cover; forest canopy; cascading over large organics and boulders; low discharge rock barrier 0.4 km above mouth and culvert barrier at hwy.	Primarily resident cutthroat trout population	Historic logging; trailed
Copper Cr. ^{b,d} (lower)	Braided channel; primarily riffle/run; limited spawning; poor instream cover; sparse riparian; possible high temperature limitations; possible flow limitations; heavy bedload movement	Equal composition of cutthroat, rainbow, and brook trout; primarily resident cutthroat trout; migratory rainbow trout population	Roaded; current, past, and historic logging
Copper Cr. ^{b,c} (upper)	Forested; steeper gradient than lower	Unknown	Roaded; past and current logging
Cougar Gulch ^a (lower)	Good spawning; moderate instream cover (large organic matter); sparse riparian; heavy bedload movement; good pool/riffle/run complex	High densities rainbow trout; migratory rainbow and cutthroat trout present; low densities of brook trout	Past and current logging; light grazing; trailed
Cougar Gulch ^b (upper)	Brush riparian with limited forest canopy; moderate instream cover; good pool/riffle/run complex	Low densities of cutthroat and rainbow trout; migratory populations present	Roaded; current and past logging
Eagle Cr.	Previous high discharges have scoured stream channel; removing much riparian in areas	Low densities of cutthroat and brook trout	Roaded; current and past logging; current and past mining
Evans Cr.	Lower 1 km is slackwater during summer; pasture areas with moderate overhanging cover; brush riparian; upper reach with conifer canopy	Migratory cutthroat trout production; used as brood-stock source by IDFG in 1970s; brook trout present	Roaded; several residences; future subdivision planned; heavy grazing/feed lot next to stream; past and current logging

Table 1, continued.

Drainage & stream	Habitat quality	Fisheries	Human activity
Coeur d'Alene River (cont.)			
Fortier Cr.	Lower 0.5 km in slack-water during summer; poor cover; good pool quantity; overall fair quality	Moderate densities of cutthroat trout; brook trout present	Partially roaded; past and present logging; grazing; residences
Fourth of July Cr.	Poor instream and riparian cover due to freeway construction; concrete flume at mouth creates passage barrier; lower pasture reach with some overhanging cover	Low densities of cutthroat and brook trout; commonly fished because of proximity to freeway	Freeway encroached severely on natural channel; concrete pools; several residences
French Gulch ^a	Some good instream cover in pools; heavy brush riparian in upper 2 km; organic input high from animal and human waste	Migratory cutthroat trout production; important spawning stream; rainbow, hybrid, and brook trout present	Roaded; heavily impacted by residences (sewage and trash); livestock use; past logging
Gimlet Cr.	Very small; extremely brushy	Rainbow and brook trout observed; no fishery	Past logging; one land owner near mouth; rest is public land
Graham Cr.	Lower reach dominated by broad riffles; root wads provide pools and instream cover; brushy riparian; upper reach not surveyed	Cutthroat, rainbow, hybrid, brook, and bull trout present; supports active fishery on resident fish	Residence near mouth, rest is public land; past logging; old logging road built in stream channel
Grizzly Cr.	Late summer flow limitation in lower 0.5 km; good overhanging cover and good pool/run complex for next 2 km; headwaters are high gradient with riffles dominant	Cutthroat, rainbow, and brook trout present	Past and recent logging
Hecla Channel	Rechanneled to route S. Fk. Coeur d'Alene R. around settling ponds; numerous habitat structures	Abundant cutthroat, hybrid, rainbow, and brook trout; kokanee and chinook salmon present	Completely reconstructed stream reach; impacted by current mining

Table 1, continued.

Drainage & stream	Habitat quality	Fisheries	Human activity
Coeur d'Alene River (cont.)			
Hunt Gulch	Very poor, very small stream	One migratory cutthroat trout found; cutthroat and brook trout present; bullhead trapped below farm pond	Several residences; livestock grazing; rechanneled by freeway construction
Latour Cr. (lower) 13 km	No riparian cover; low gradient; run/riffle complex; very few pools; poor overall habitat	Cutthroat and brook trout present; supports a fishery; migratory cutthroat trout present	Roaded; severely rechanneled; past and recent logging; past sawmill operation
Latour Cr. (upper)	High gradient; brush and forest canopy	Cutthroat and brook trout present; migratory cutthroat trout present	Roaded; past and recent logging
Little Teepee Cr. ^b	Very small, very dense vegetation	Brook trout present	Road at mouth and at headwater
Lost Cr. (including E. Fk. Lost Cr. and Hat Cr.)	Good overall habitat quality; high gradient; channel constructed in lower 2 km; moderate brush riparian; instream cover primarily boulders	Low densities of cutthroat, rainbow, hybrid, and brook trout	Roaded in lower end only
E. Fk. Pine Cr. (including Trapper Cr.)	Poor overhanging cover; primarily cobble substrate; low quality pools; no riparian	Cutthroat and brook trout provide limited fishery	Roaded; rechanneled because of 100-year flood; past and current mining; past logging
Robinson Cr.	Poor overall habitat in lower reach; upper reach with moderate brush riparian; conifer canopy; pool/riffle ratio 1:2	Resident cutthroat trout found throughout drainage; little fishery value	Partially roaded; rechanneled in lower reach; farming, pasture in lower reach; past and recent logging
Rose Cr.	Intermittent in late summer; lower reach affected by Lake Coeur d'Alene water level; swampy	Resident cutthroat trout present; limited fishery	Partially roaded; agriculture in lower reach; past and recent logging

Table 1, continued.

Drainage & stream	Habitat quality	Fisheries	Human activity
Coeur d'Alene River (cont.)			
Scott Cr.	High gradient; riffles dominate; scarce pools provide good habitat	Cutthroat and rainbow trout present; provides limited fishery	Lower 2 km roaded; road encroachment on stream channel; culvert at river road is fish barrier; natural fish barrier at low flow 1 km from mouth; past logging
Skeel Gulch ^a	Good overhanging and riparian cover and thermal protection; forested in upper reach	Very good production of migratory cutthroat trout	Roaded; lower end rechanneled and concrete flume constructed by landowner; agriculture in lower 2 km
Steamboat Cr. (including E. Fk. and W. Fk.)	High gradient (increased by road); poor pool/riffle ratio; shaded by forest canopy; habitat severely degraded .	Low densities of cutthroat, rainbow, hybrids, and brook trout	Roaded; several primitive campsites; past, recent, and current logging
Thompson Cr. (including W. Fk.)	Limiting late summer flows and temperatures; moderate riparian cover	Low densities of cutthroat and brook trout; poor fishery potential	Roaded; ranching; past and recent logging
Willow Cr.	Low gradient; poor overhanging; or instream cover; no riparian; lower reach influenced by Lake Coeur d'Alene water level	Some migratory cutthroat trout present	Severe impacts from livestock grazing and farming; past logging

^aVery important migratory cutthroat trout production.^bHabitat not surveyed.^cFish populations not inventoried.^dVery important migratory rainbow trout production.

is abundant, salmonid territories decrease, as do aggressive interactions, allowing fish densities to increase. Food availability also increases. Unfortunately, habitat and population relationships were masked in the data. In general, instream cover was sporadic, and when averaged over an entire surveyed reach, appeared less associated with fish densities. Elapsed time between snorkeling and habitat surveys varied from the same day to 6 weeks; time enough for changes (water level, temperature) to occur in small streams.

Tributaries that have good quality habitat and support adequate production of trout should be protected. Of priority are streams that support migratory cutthroat trout populations. Such tributaries to the lower Coeur d'Alene River are French Gulch, Skeel Gulch, Latour Creek, Cougar Gulch, and Graham Creek. Tributaries to the lower St. Joe River that need protection for migratory stocks are upper Benewah Creek and tributaries, lower Cherry Creek, Thomas, Bond, Trout, and Mica creeks. Alder, Carlin, Flat, Soldier, Merry, Renfro, Charlie, Cat Spur creeks, and tributaries to Santa Creek in the St. Maries River drainage need protection. Streams that support resident populations of either or both cutthroat and brook trout should also be protected. Such streams are: Cougar Gulch, Latour, Pine, Copper, and Graham creeks in the Coeur d'Alene River drainage; Cherry, Street, Falls, Reeds Gulch, upper Trout, and upper Mica creeks in the St. Joe River drainage; and Canyon, Alder, Beaver, Crystal, upper Sheep, Renfro, Davis, upper Carpenter, and Merry creeks in the St. Maries River drainage.

Lower French Gulch (Coeur d'Alene River), Benewah Creek (St. Joe River), and Thorn Creek (St. Maries' River) are examples of important cutthroat trout spawning streams that have poor holding and rearing habitat. Very productive tributaries to Benewah and Thorn creeks may lead to bias of production estimates from the main streams.

The lack of cover within pools may be the most important factor limiting trout production in the three river systems. Until recently, standard logging practices included removing all logging debris from stream channels, a practice which has been shown to be a detriment rather than enhancement to fish populations (Marzolf 1978; Bryant 1983; Elliot 1986). Now some proportion of woody debris remains, serving as instream cover for trout. Streams logged prior to this change in management are depauperate in instream cover. Optimum levels of large organic matter in salmonid streams have not been specifically determined (Bisson et al. 1987), however more is generally better, provided fish passage is maintained (Sedell et al. 1985). Cunjak and Power (1987) demonstrated that instream cover was used by brook and brown trout more than overhanging cover in an ice-free stream during winter, and instream cover was a higher criterion for winter habitat selection than stream depth. Sixty-nine percent of the stream reaches we surveyed had less than 10% large organic matter as a cover component. Enhancement of large organic matter should provide increases in rearing habitat and food production and allow higher trout densities as a result of smaller territories. French and Skeel gulches in the Coeur

d'Alene River drainage; lower Bond, lower Trout, upper Mica, lower Street, lower Thomas, and middle-upper Benewah creeks in the St. Joe River drainage; and middle-upper Alder, lower Flat, lower-middle Soldier, lower-middle Carlin, middle-upper Renfro, lower Olson, lower-middle Charlie, middle-upper John, and Thorn creeks in the St. Maries River drainage would benefit from increased instream cover of large organic matter (all streams have been listed by priority of needs and expected benefits to trout populations from enhancement efforts).

Overhanging vegetation not only provides good cover for fish but also buffers stream temperatures, provides bank stability and habitat for insect production, and promotes allochthonous nutrient input to the stream (Vannote et al. 1980; Beschta et al. 1987). Hunt (1969) observed a 40% increase in standing crop of brook trout in a Wisconsin stream following habitat enhancement which involved, in part, increasing overhanging bank cover by 416% and decreasing surface area by 50%.

Because of the strong positive relationship between heavy livestock use and degraded streambanks, we recommend livestock exclosures be constructed on the following streams, listed by priority for each drainage: lower French Gulch on the Coeur d'Alene River; upper-middle Benewah Creek including some tributaries, lower Bond, upper Mica, lower Street creeks, and lower Reeds Gulch on the St. Joe River; and lower-middle Renfro, lower Charlie, lower Olson, lower Thorn, upper Canyon, and upper-middle John creeks in the St. Maries River drainage. The Middle Fork St. Maries River above Merry Creek and the St. Maries River between Merry Creek and Mashburn would also benefit from cattle exclosures. Habitat in Beaver Creek, West Fork St. Maries River, and lower-middle Merry Creek also suffer from livestock grazing, but have less potential for increased trout production.

Removal of the partial bedrock barrier on Alder Creek should be considered. This barrier was altered in 1965 by the Department to aid upstream migration. Currently, many adult cutthroat trout congregate below the barrier until adequate discharge allows passage upstream. Evidence of activity (i.e., fishing tackle, garbage) was found there out of season and conservation officers have cited people fishing there illegally (Bill Carter, Idaho Department of Fish and Game, personal communication). We believe illegal harvest of these trout could be impacting the run.

Current garnet mining operations in Carpenter Creek, tributary to St. Maries River, cause continuous sedimentation problems.

For the most part, tributaries to the three rivers, within our surveyed area, not evaluated for fish populations or habitat were deemed unimportant for fish production. Exceptions were Big and Bear Pete creeks in the St. Joe River drainage and Emerald Creek in the St. Maries River drainage.

Several tributaries were surveyed during late summer and no spawning sites were identified, yet earlier electrofishing samples indicated that reproduction of trout occurred. Spawning gravel that was exposed at low flows was not included in the survey. Lukens (1978) found tributaries to Wolf Lodge Creek that completely dried up in summer, yet were productive

spawning streams in the spring. Cutthroat trout fry would migrate downstream to larger waters shortly after emerging from the gravel. Small streams that are used by cutthroat trout for spawning may often be overlooked as unimportant because of their appearance during late summer. We accounted for known bias from the habitat surveys regarding spawning habitat when we noted spawning gravel quality in Table 1.

Woody debris and streamside vegetation contribute to channel stability, trapping of sediment, and complex hydraulic patterns. Consequently, diverse habitats, including spawning habitat, are formed in a stream (Everest et al. 1987). Spawning habitat should indirectly increase in response to other habitat enhancement in the aforementioned streams.

We found a trend of higher rainbow trout to cutthroat trout densities in streams with higher percentages of riffles over pools and with stream gradients exceeding 3%. Brook trout have become the dominant species in many streams with low gradient ($<1\%$) and warmer water temperatures ($\geq 18^{\circ}\text{C}$).

ACKNOWLEDGEMENTS

We thank Terry Elms-Cockrum, Duane Von Bargen, Susan Ortega, Mike Rowe, and Steve McNeill for their time and effort spent collecting and summarizing habitat data. Professional assistance was given by Bob Rainville and Ed Lider of the U.S. Forest Service. We thank Mary Lou White and Charlene Manning for entering our data on the Forest Service general computer and Office Coordinator, Anna Marie Halpern, for typing tables and appendices.

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A P P E N D I C E S

District #		Reach #		Stream Name		Date												
Forest #		Elevation Start		Elevation End		Total Reach Distance												
Valley Bottom		Channel Type		Stream Order		Stream Temp		Air Temp										
H A B T Y P E	L E N G T H F T	U I D T H F T	G R A D I E N T %	P O O L C R E A T O R	COVER COMPONENTS (PERCENTAGE)						SPAWNING AREA			F I N E S T I M A T E D S H O O T S	REMARKS			
					L O O M	S T R E E T	S H A D O W S	O T H E R	U N D E R S T R U C T U R E S	O T H E R	S P A W N I N G	A R E A	S P A W N I N G					
																S P A W N I N G	A R E A	S P A W N I N G
(* NOTE TYPE)																		

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STREAM SURVEY INSTRUCTIONS

June 1987

The primary objectives in performing stream surveys are:

To identify existing stream habitat conditions: suitabilities,
limiting factors, sensitivities;

To determine management needs: improvement projects, riparian
treatments;

To assess the positive and negative effects of land management
activities on a stream's carrying capacities.

The information collected should be compiled and interpreted within a riparian management plan which will provide long term direction (10 years) for the management of the stream and the associated riparian vegetation.

A stream survey begins by identifying stream reaches. A reach is a section of stream with the same potential for biological production and physical alteration. The stream length included in a reach should have a similar gradient ($\pm 1\%$), valley bottom and stream order. A reach should be at least 1/4 mile long. Initially streams should be divided into reaches using a topographic map but a more refined division will be possible when the stream is surveyed.

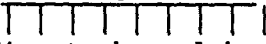
Streams are surveyed by walking each reach and recording data across 5 foot wide transects located 50 feet apart. For streams wider than 25 feet, 10 foot wide transects may be used at 100 foot intervals. In all cases, at least 10% of a reach should be surveyed.

In addition to the survey forms, a topographic map should also be used to compile data. A map with a scale of at least 2.64 inches per mile is recommended. The following information should be noted on the map:

- a) Stream reaches.
- b) Trout migration barriers:

Full barrier: _____	FB	Culvert: C
Partial barrier: ----	PB	Debris: D
Total barrier: T		Beaver: B
High water barrier: H		Falls: F
Low water barrier: L		Cascade: Ca
- c) Debris jams needing treatment:
 - If not a barrier: D ...
- d) Beaver dams:
 - If not a barrier: B ...
- e) Slides, slumps, and other sediment sources:

S


- f) Significant channel braiding:
 - Brd ---->
- g) Dry lengths of the stream.
- h) Specific riparian timber stands which correspond to the stand designation indicated on the survey form.
- i) Segments of the stream actually surveyed if the stream is spot checked.
- j) Any other feature which will be useful to locate.

Appendix B, continued.

FORM 1

Most recent form: June 1987 or 06/87

The following is a brief explanation of the items to be noted on the stream survey form. The items that are underlined appear as they are noted on the survey sheet and computer. The number of spaces on the computer display are indicated.

Sign on to your Data General Computer

Go to the Information System Area

Choice: # 1. Access

Level: # 2. Staff

Drawer Name: FISH

Folder Name: HABITATEVALUATION

Command: FISH_MENU

Your index key (shift/F2) will display
the commands available to you.

ALPHA LOCK - Be sure to have your alpha lock key on so all stream names are in capitals - insuring consistency in data entry. THIS IS VERY IMPORTANT!

Main Menu: #1. Documentation Instructions will scroll on the screen. Be prepared to use your Hold key! To exit out of the documentation before it is complete Press CTRL C, Then CTRL A..

Main Menu: # 2. Add/Change/or Delete Stream Survey Data
The following screen will appear:

Please Select: _

1. Add (new stream)
2. Change/Inquire (change existing data)
3. Delete Record (delete one screen of information) Y
= screen will be deleted
N = screen will not be deleted
4. Print Record (not available at this time)

TO CANCEL OUT: Must be at the beginning of screen or the end of a screen. Press the function key F8. That will back you out one screen at a time. The second F8 takes you to -Main Menu-. From here you can select #7 (when doing a deflected access into the SO #9 is exit) to exit out of the program back to the command level in IS. CTRL/SHIFT/F1 takes you off the system from the command level.

BREAK ESC This is used when you are entering data to a site. If you make mistakes (especially on line 1) and wish to start this site over. Press the BREAK ESC button - you will be prompted at the bottom of the screen that RECORD NOT PROCESSED PRESS CR. Just hit new line and proceed to enter the record again.

District # 2 spaces

(numeric code)	
01 = Wallace	06 = . Sandpoint
02 = Avery	07 = Bonners
03 = Fernan	08 Priest Lake
04 = St. Maries	09 = Red Ives

Stream #: 3 spaces - Each stream should have its own number. The number used should be recorded on the file, form and on a stream index developed by the district.

Reach #: 2 spaces - Reaches are stream segments with the same gradient (<2%, 2 to 4%, 5 to 9%, >10%), stream order and channel type.

Site #: 3 spaces - Designates survey site number. (Data Entry: NOTE the number you give the site on the survey. forms in pencil.)

Computer Note - After hitting New line you are able to F7 down to #13 Habitat Type. Use this after first site information has been entered.

2. Stream Name: 20 spaces - Please use NF, E for example to designate North Fork or East for consistency also, DO NOT use Creek as part of name.
3. Date: 6 spaces - Self-explanatory
4. Forest #: 2 spaces - 04 for Idaho Panhandle
5. Elevation Start: 5 spaces - Elevations at the start and end of the reach will be determined from topography maps (numeric in feet). Altimeters will be used to locate features within the reach.
8. Elevation End: 5 spaces - The elevation of the ending point of the stream reach surveyed (numeric in feet).
7. Total Reach Distance: 5 spaces - (taken off map total distance in feet)

Using a Planimeter, and a 7.5 minute map, code to enter is 2000.
Using a Planimeter on a 1" to the mile map code is 5208.

ON MAP - Check map scale with map wheel

If using a map wheel to determine the distance, use the calculations below:

If map scale = 1 inch/i mile, Then
$$\frac{\text{Total inches}}{1} \times 5280 \text{ ft.} = \text{Reach distance in feet}$$

If map scale = 4 inches/1 mile, Then
$$\frac{\text{Total inches}}{4} \times 5280 \text{ ft.} = \text{Reach distance in feet}$$

If map scale = 2.64 inches/1 mile, Then
$$\frac{\text{Total inches}}{2.64} \times 5280 \text{ ft.} = \text{Reach distance in feet}$$

Appendix B, continued.

8. Valley Bottom: 1 space - Select the appropriate valley bottom type

numeric code:	CODE	VALLEY BOTTOM	DESCRIPTION
	1	∨	The valley side slopes restrict the meander pattern of the stream.
	2	∨/	The valley side slopes influence the meander pattern of the stream.
	3	—	The valley side slopes rarely influence the meander pattern of the stream.

9. Channel Type: 2 spaces - Select the appropriate channel type

numeric code:	CODE	CHANNEL TYPE	GRADIENT	VALLEY BOTTOM
	01	A	>5%	∨
	02	B	2-5%	∨/
	03	C	1%	—

10. Stream Order: 1 space - numeric - 1, 2, 3, or 4. Stream order is based on a hydrologic system in which all channels (both intermittent and annual) are considered. Map scales of 2.64 inches/mile (7 1/2 minute) will be the standard maps used in determining stream order.

11. Stream Temperature: 2 spaces - numeric in degrees centigrade

Formula: (Degrees F - 32) x 5/9 = Degrees C

12. Air Temperature: 2 spaces - numeric in degrees centigrade

13. Habitat Type: 3 spaces - numeric code

001 = Class 1 pool	005 = Run
002 = Class 2 pool	006 = Pocketwater
003 = Class 3 pool	007 = Glide
004 = Class 4 pool	008 = Riffle

Pools: Pools are basins or depressions in the channel caused by the scouring of high flows. Low surface velocities exist. Pools end where the stream bottom approaches or contacts the water surface (pool tailout) and therefore may include some glide or run.

Pools should be rated according to their area, depth, and in stream cover. These three parameters should be evaluated and assigned points based on the criteria listed on Table #1. The pool class can then be determined from the sum of these points according to the following scale:

TOTAL POINTS	POOL CLASSES
8-9 . .	1
7	2
5-6	3
4-5	4

The total of five points for Class #3 pools must include two points for depth and two points for cover. The number of each pool class should be recorded for a length of stream within the segment being surveyed.

Foam and surface turbulence should not be used in rating pool cover, however if these cover types are significant they could be noted on the field form as "Cover Other" and identified in the "Remarks" section.

TABLE #1

PARAMETER	DESCRIPTION	POINTS
AREA	The length or width of the pool is 50% larger than the average stream width.	3
	The length or width of the pool is nearly	2
	The length or width of the pool is 50% smaller than the average stream width.	1
DEPTH	The deepest part of the pool is greater than three feet deep.	3
	The deepest part of the pool is two to three feet deep.	2
	• The deepest part of the pool is less than two feet deep.	1
COVER	> 50% (Abundant cover)	3
	25 - 49% (Partial cover)	2
	< 25% (Exposed)	1

Run: Run is a habitat type with laminar flow where the surface of the water is not disturbed by the surface of the stream bottom. The depth is generally deeper than a riffle or pocketwater and the current is more than in a pool.

Pocketwater: Pocketwater is a stream segment with boulders (greater than 1 foot in diameter) or scattered obstruction throughout what otherwise could be considered riffle. The obstructions, usually boulders, with eddy currents create numerous small pools. At least 25% of the stream segment must be comprised of pockets (not including the obstructions) to be considered pocketwater. Pocketwater is normally on steeper gradients relative to other habitat type in the reach.

Glide: Glides are run areas with velocities generally less than 1 foot/second, and a smooth surface. Water depth is generally less than 2 feet.

Riffle: Riffles are shallow water areas of higher velocities where the surface of the water is disturbed by the surface of the stream bottom. The gradient is steeper relative to other habitat types in the reach, and the surface is turbulent (white water areas). Stream depth is generally less than encountered in a pool or run.

Where 2 or more habitat types or split channels are encountered at the same site, information should be collected for each habitat type using a separate line for each habitat type (see Length, below). Braided channels should be noted in the Remarks and of the field map.

Appendix B, continued.

	<u>POOL</u>	<u>GLIDE</u>	<u>HUN</u>	<u>POCKETWATER</u>	<u>RIFLE</u>
Current:	None	Low	Yes	Yes	Yes
Depth (relative):	Most	Low/Mod	Mod	Low/Mod	Low
Obstructions: (Boulders >1 foot)				≥ 25%	≤ 25%
Gradient:	Lower	Lower	Higher	Higher	Higher

14. Length (numeric): 3 spaces - length of the transect in feet. This will usually be 5 feet except on streams wider than 25 feet or where multiple habitats are encountered. For streams wider than 25 feet, transects longer than 5 feet should be used. A greater distance between transects should also be adopted. The distance and length adopted should insure that at least 10% of the reach is surveyed.

If more than one habitat type exists across a transect, information for each habitat type should be recorded separately. The length used should be based on the percentage of the channel width occupied by the habitat type.

Percent of the Total Channel Width	Length Recorded
20	1
40	2
60	3
80.	4

15. Width (numeric): 2 spaces - Width measurements should be taken at all sites in feet. The wetted width and not the physical channel width should be measured. The width of the watered stream channel (present) channel should be measured at a 90 degree angle to the stream flow. The measurements should be entered on the form according to the appropriate stream condition (pool, riffle, run). Actual width measurements should be taken for each habitat type, at least 5 to 10 measured in a reach and the others can be estimated.

16. Percent Gradient: 2 spaces - numeric code, e.g. 01 = 1%, 10 = 10%. Gradients should be measured at randomly selected sites along the survey. From 5 to 10 gradient measurements should be made for each reach. Clinometer measurements should be taken regularly to determine the overall gradient. Do not enter the gradient if it is over 35%.

17. Pool Creator: 2 spaces - numeric code, The factors causing the pools recorded above should be indicated. BE SURE TO ENTER A.CREATOR FOR A POOL.

01 = Large organic material (logs, root wads)	04 = Beaver dams
02 = Boulders, bedrock	05 = Other
03 = Meanders, bank	(note in remarks)

18-22. Cover Components (%): 2 spaces - numeric code as a percent of the stream area in pools, run, or pocketwater which has cover provided by the cover types noted. Do not consider cover in riffles. Only logs, undercut banks and vegetation within 1 1/2 feet of the stream surface would be considered as cover.

Appendix B, continued.

18. Large Organic Material (logs, root wads)
19. Boulders, bedrock (please note in remarks if bedrock)
20. Undercut Bank
21. Overhanging Vegetation Overhanging vegetation that acts as cover for fish, extending over water and within 18" of stream surface.
22. Other * Note in type in remarks

EXAMPLE:

00 = 0 %

05 = 5%

50 = 50%

*98 = 100% not enough space for 100-ALSO computer reads 99 as end of data entry for the reach.

23. Other Cover-Type: 2 spaces - numeric code

01 = Depth (contact S.O. before establishing new cover type)

02 = Aquatic Vegetation

24. Spawning Sites Number: 2.spaces - total NUMBER (Not Area) of spawning sites for each habitat where they are found.

01 = 1 spawning site 10

= 10 spawning sites

Spawning habitat: The number of suitable spawning sites present in the habitat type. As a generalization, suitable spawning habitat for cutthroat, bull, rainbow, and brook trout will be considered a minimum area of two square feet areas consisting of gravels between 0.5 and 3 inches and with velocities between 0.5 and 3 foot per second. The bed size is a minimum of 4 feet square and usually located at pool tailouts or along banks. If this definition is not appropriate for the population using the stream, the exception should be noted on the form and percentage of the stream area in this exceptional condition should be recorded. (See additional information). If large continuous gravel beds are encountered each site should be considered 25 feet square

25. Spawning Site Creator: 2 spaces - numeric code - structure that formed the spawning site. * BE SURE TO ENTER A CREATOR FOR SPAWNING SITE.

01 = Large organic material

04 = Gradient

02 = Boulders, bedrock

05 = Braiding

03 = Meanders, bank .

06 = Other (note in

Pools should not be considered as a spawning site creator. Rather the feature which is responsible for the pool should be noted.

26. Percent Fines: 2 spaces - numeric code - % fines measured in the spawning site area; a minimum of 5 samples/reach should be done. The percentage of 1/4" and smaller materials in the first 3 to 4 inches of the spawning site should be estimated.

01 = 1%

10 = 10% etc.

Appendix B, continued.

27. Fines-Method: 2 spaces - numeric code - the method used in measuring fines.

01 = Ocular
02 = Box Sieve
03 = Core Sample

The Habsum data base has 3 screens. The third is used to enter emergence success estimates. The columns are set up for species specific estimates and the rows indicate the method used to derive the estimate.

			SCREEN 3			
EMERGENCE: CUTTHROAT RAINBOW			BULLTROUT	BROOKTROUT	KOKANEE OTHER	
METHOD 1:	1.	2.	3.	4.	5.	6.
METHOD 2:	7.	8.	9.	10.	11.	12.

Method 1 is based upon Bjornn and Irving's, (1984) relationships using 1/4" fines and the box sieves.

Method 2 is based upon Bjornn and Irving's, (1980) relationships using 0.85 mm and 9.5 mm box sieves.

Method 6 is based upon Bjornn and Irving's, (1984) relationships using 1/4" fined from core sample.

Method 7 is based upon Bjornn and Irving's, (1984) relationships using 0.85 mm and 9.5 mm sieve and core samples.

Method 10 row is reserved for the emergence estimate based on the Forest Plan survival curve (Entry Number 55). Entries 56 - 60 can be used to evaluate survival levels resulting from project alternatives.

Methods 3, 4, 5, 8, and 9 have not been identified but will be in future.

28 & 29 Remarks - space available (Enter surveyor's remarks e.g. sediment sources, habitat improvement projects, data collected from core samples, ocular, box sieve. Please also note fish species, quantity and sizes. The features such as debris jams, slides, and channel braiding should be noted in the remarks section and on the survey map.

Computer -Note CTRL E - will allow you to insert space if needed between words, on allotted line. CTRL F moves cursor to next word. CTRL B moves cursor back.

30. CODE: 0 (LEAVE BLANK!) USED TO MARK END OF DATA BASE BY COMPUTER!

Any Changes? Opportunity to change incorrect information except for line #1. Enter field number, NEW LINE, then the change to be made.

At the end of each stream reach enter another site number. From #13 - #27 enter all spaces with 9's to signal computer end of reach.

#28 & 29 enter 99. #30 CODE: 0 (LEAVE BLANK!).

Appendix B, continued.

STREAM HABITAT TYPE DEFINITIONS
FOR STREAMS LESS THAN 25 FEET WIDE
(Conditions during low flow periods)

RUN: Run is a habitat type with laminar flow where the surface of the water is not disturbed by the surface of the stream bottom. The depth is generally deeper than a riffle or pocketwater and the current is more than in a pool.

POCKETWATER: Pocketwater is a stream segment with boulders (greater than 1 foot in diameter) or scattered obstructions throughout what otherwise could be considered riffle. The obstructions, usually boulders, with eddy currents create numerous small pools. At least 25% of the stream segment must be comprised of pockets (not including the obstructions) to be considered pocketwater. Pocketwater is normally on steeper gradients relative to other habitat type in the reach.

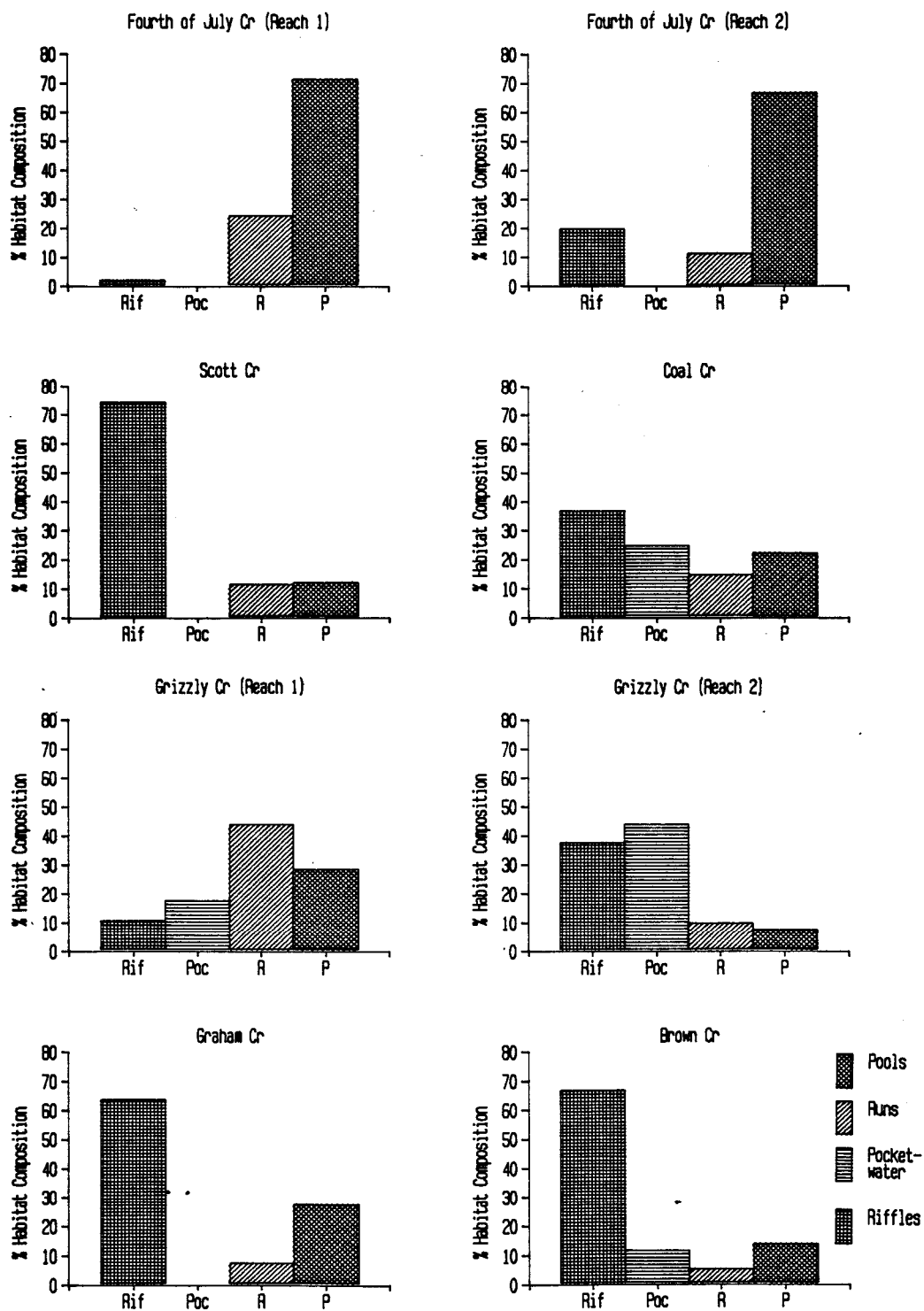
GLIDE: Glides are run areas with velocities generally less than 1 foot/second, and a smooth surface. Water depth is generally less than 2 foot.

RIFFLE: Riffles are shallow water areas of *higher* velocities where the surface of the water is disturbed by the surface of the stream bottom. The gradient is steeper relative to other habitat types in the reach, and the surface is turbulent (white water areas). Stream depth is generally less than' encountered in a pool or a run.

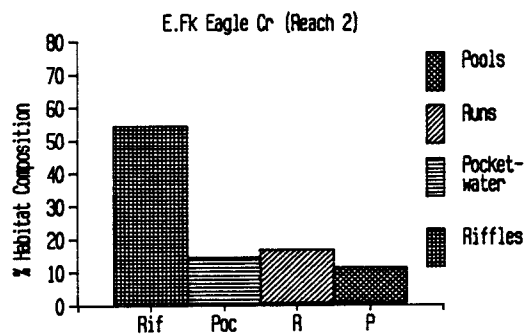
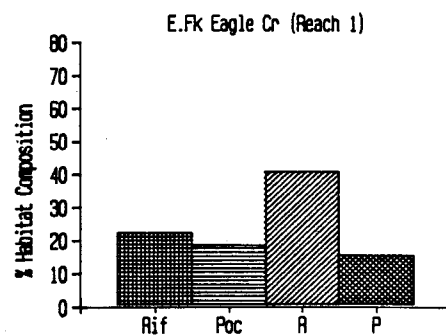
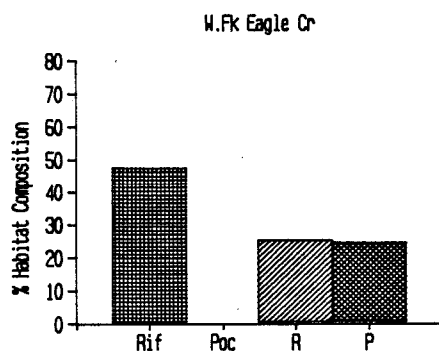
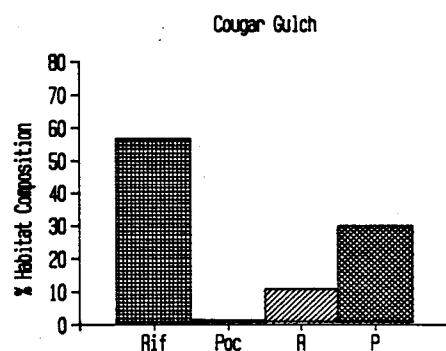
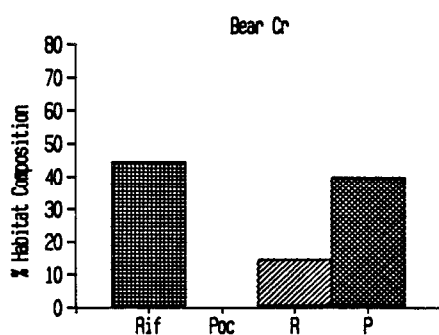
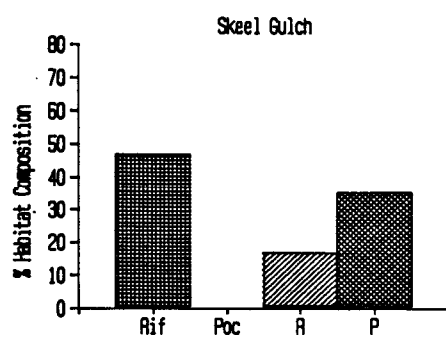
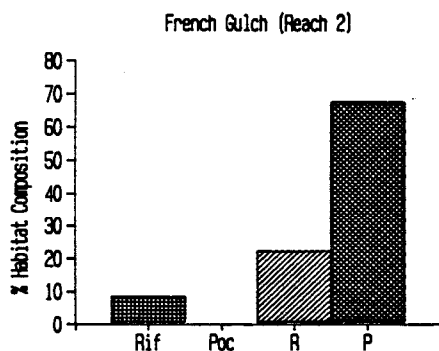
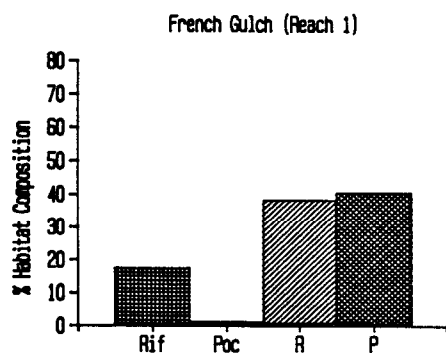
POOLS: Pools are basins or depressions in the channel caused by the scouring of high flows. Low surface velocities exist. Pools end where the stream bottom approaches or contacts the water surface (pool tailout).and therefore may include some glide or run.

	POOL	GLIDE	RUN	POCKETWATER	RIFFLE
Current:	None	Low	Yes	Yes	Yes
Depth (relative):	Most	Low/Mod	Mod	Low/Mod	Low
Obstructions: (Boulders >1 foot)				> 25%	≤ 25%
Gradient:	Lower	Lower	Higher	Higher	Higher

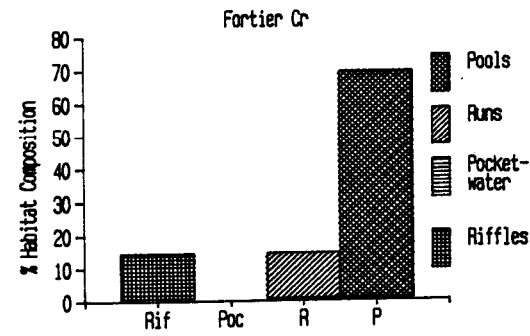
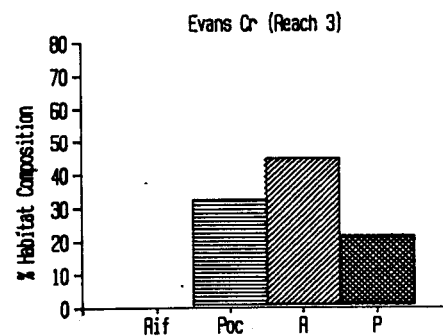
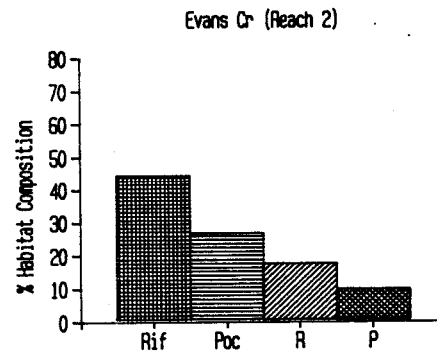
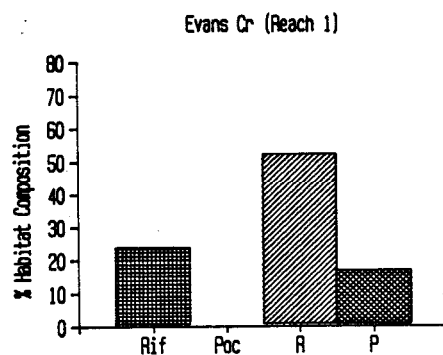
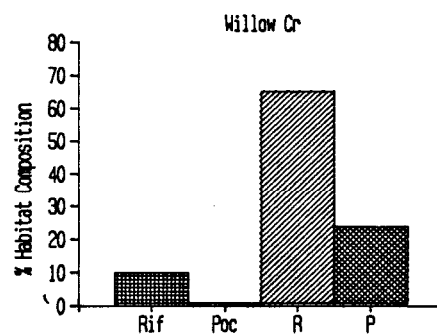
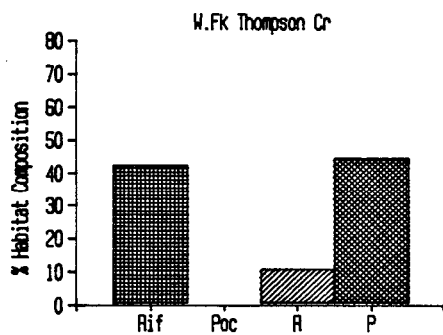
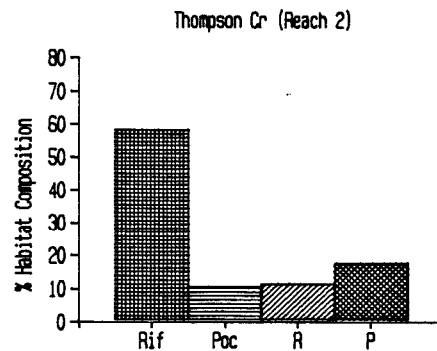
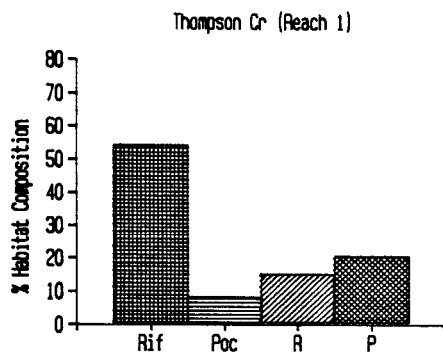
Appendix C. The proportion of pools, runs, pocketwater, and riffles in tributaries to the Coeur d'Alene, St. Joe, and St. Maries rivers, 1985 through 1987.



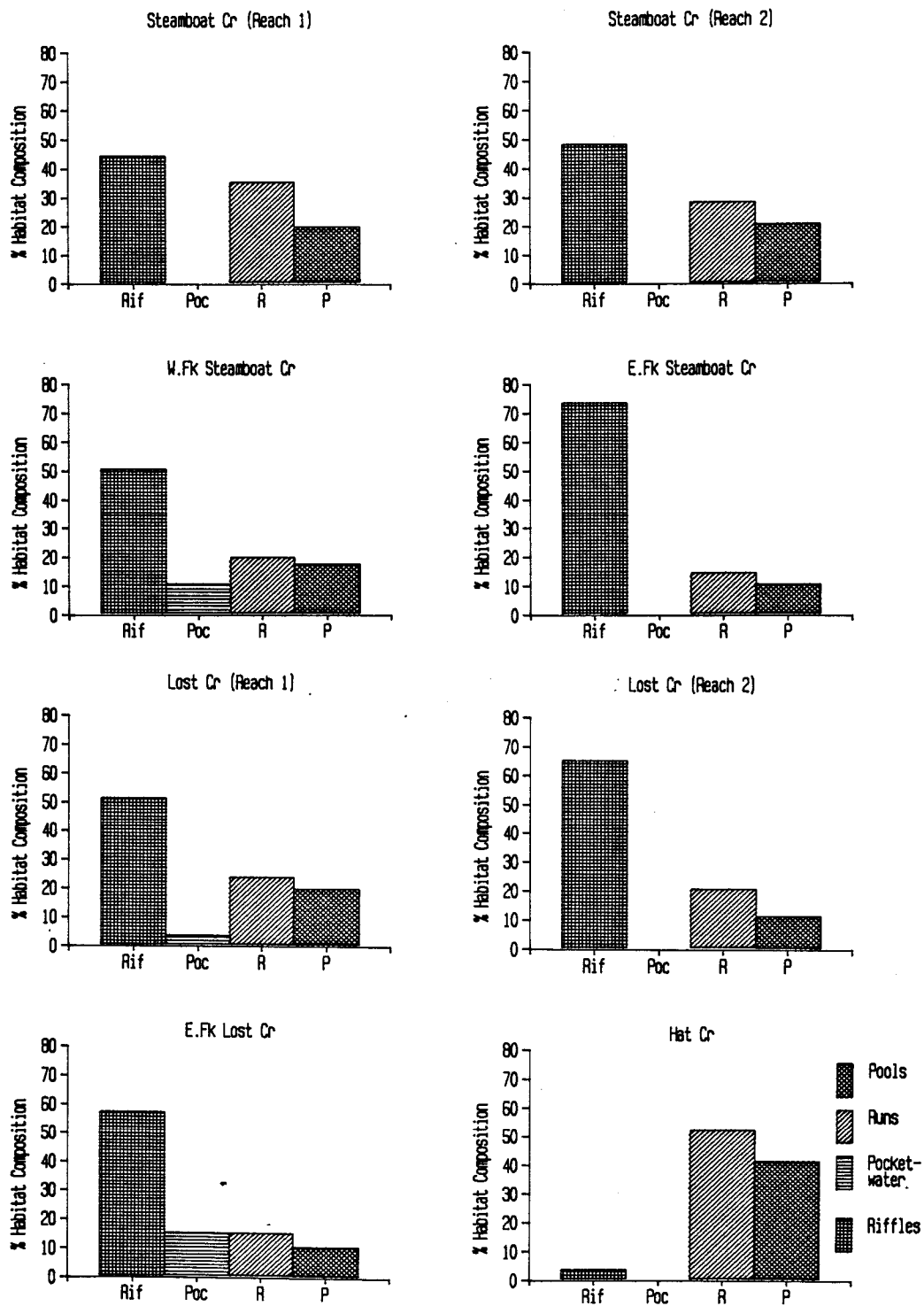
Appendix C, continued.



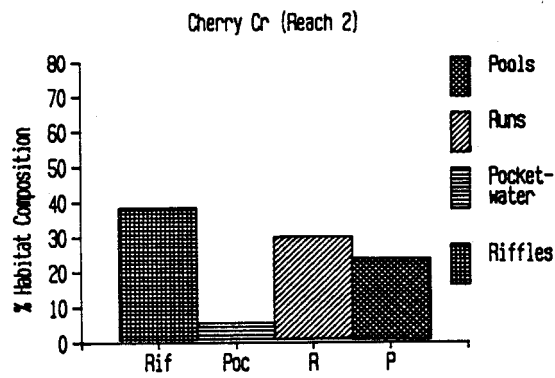
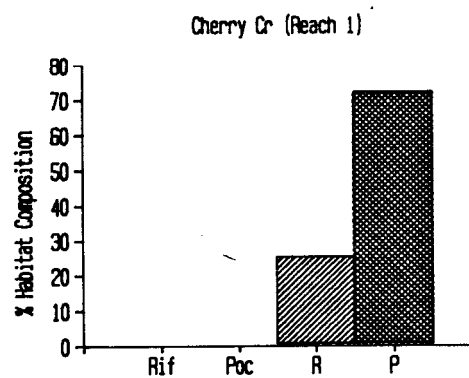
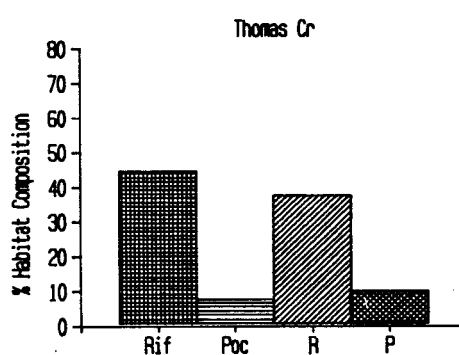
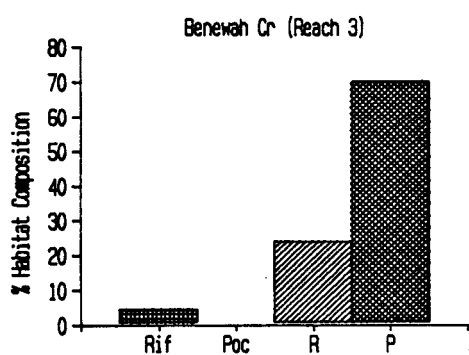
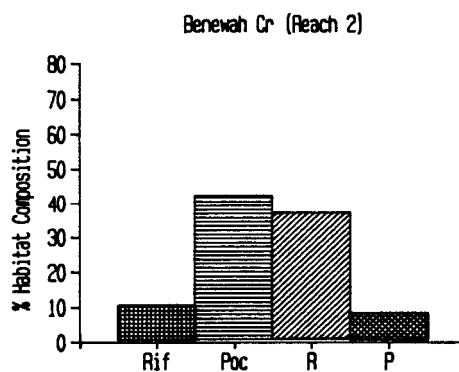
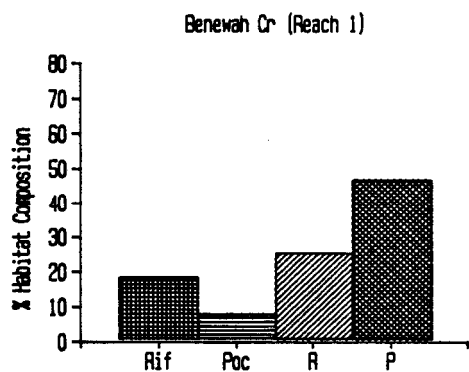
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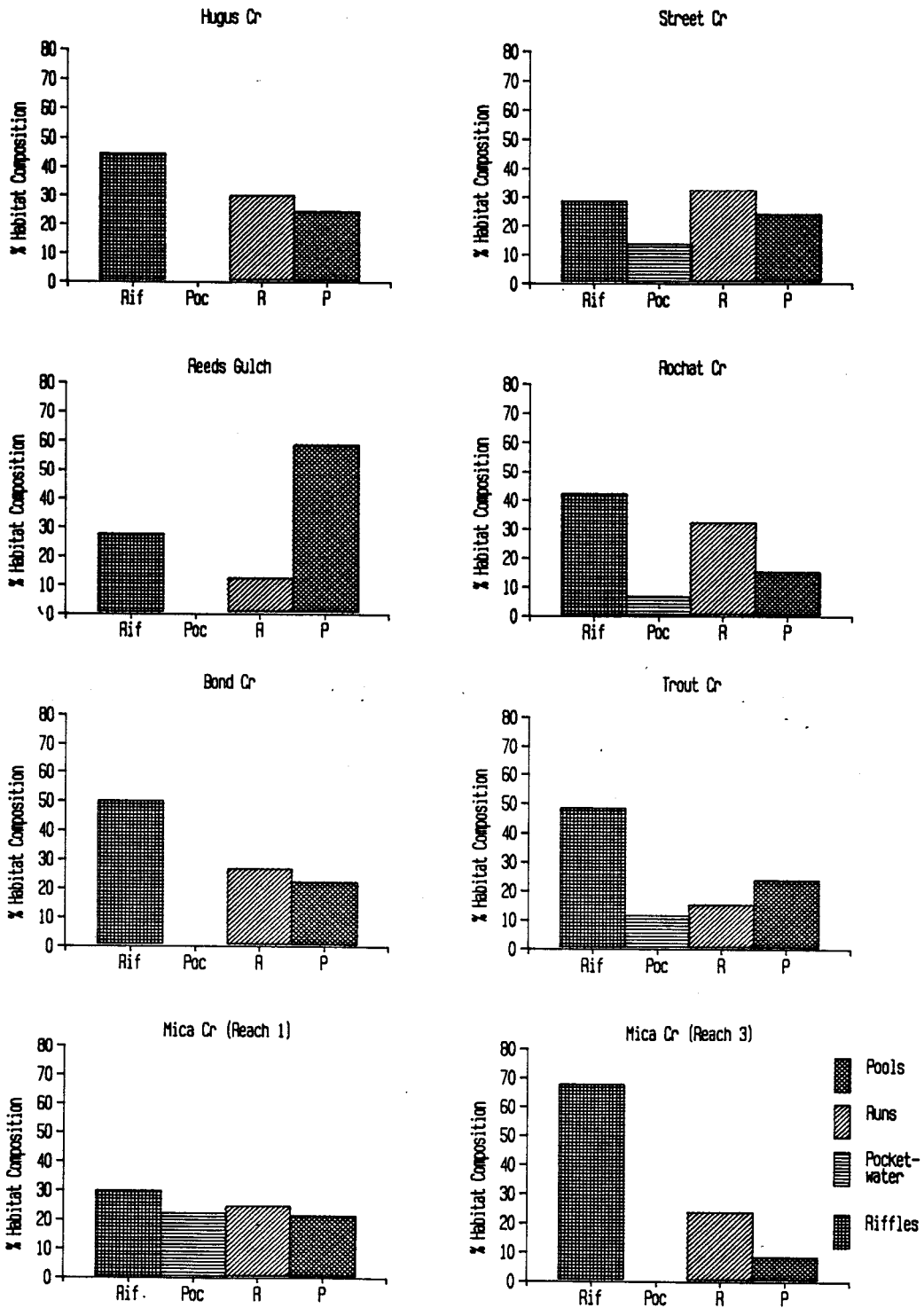
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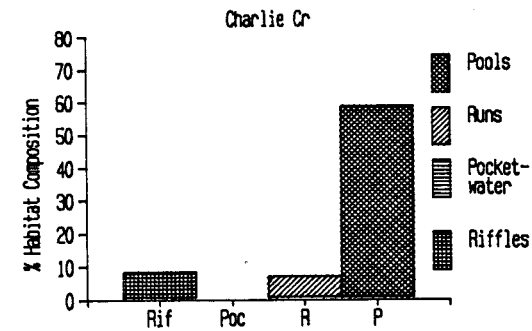
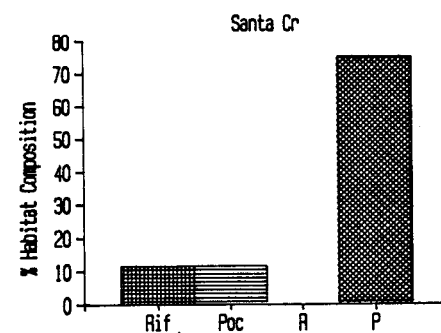
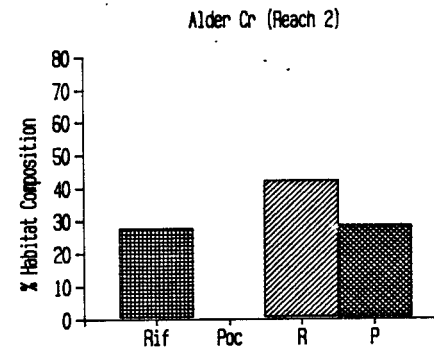
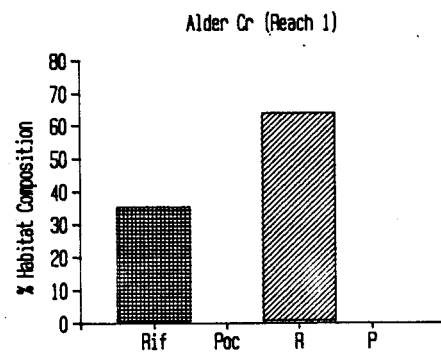
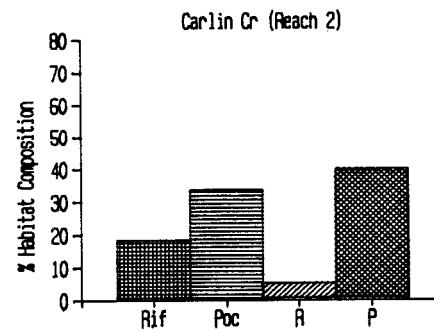
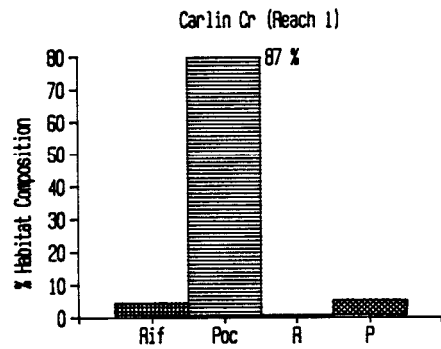
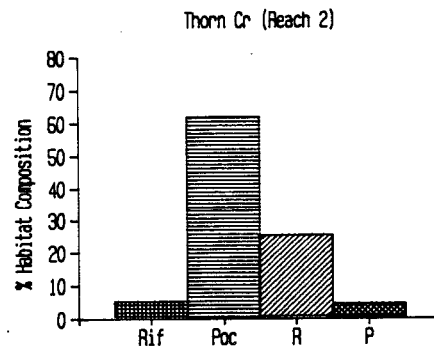
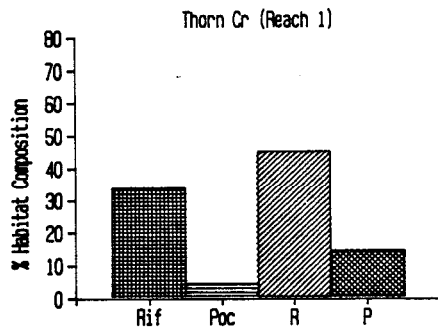
Appendix C, continued.



Appendix C, continued.

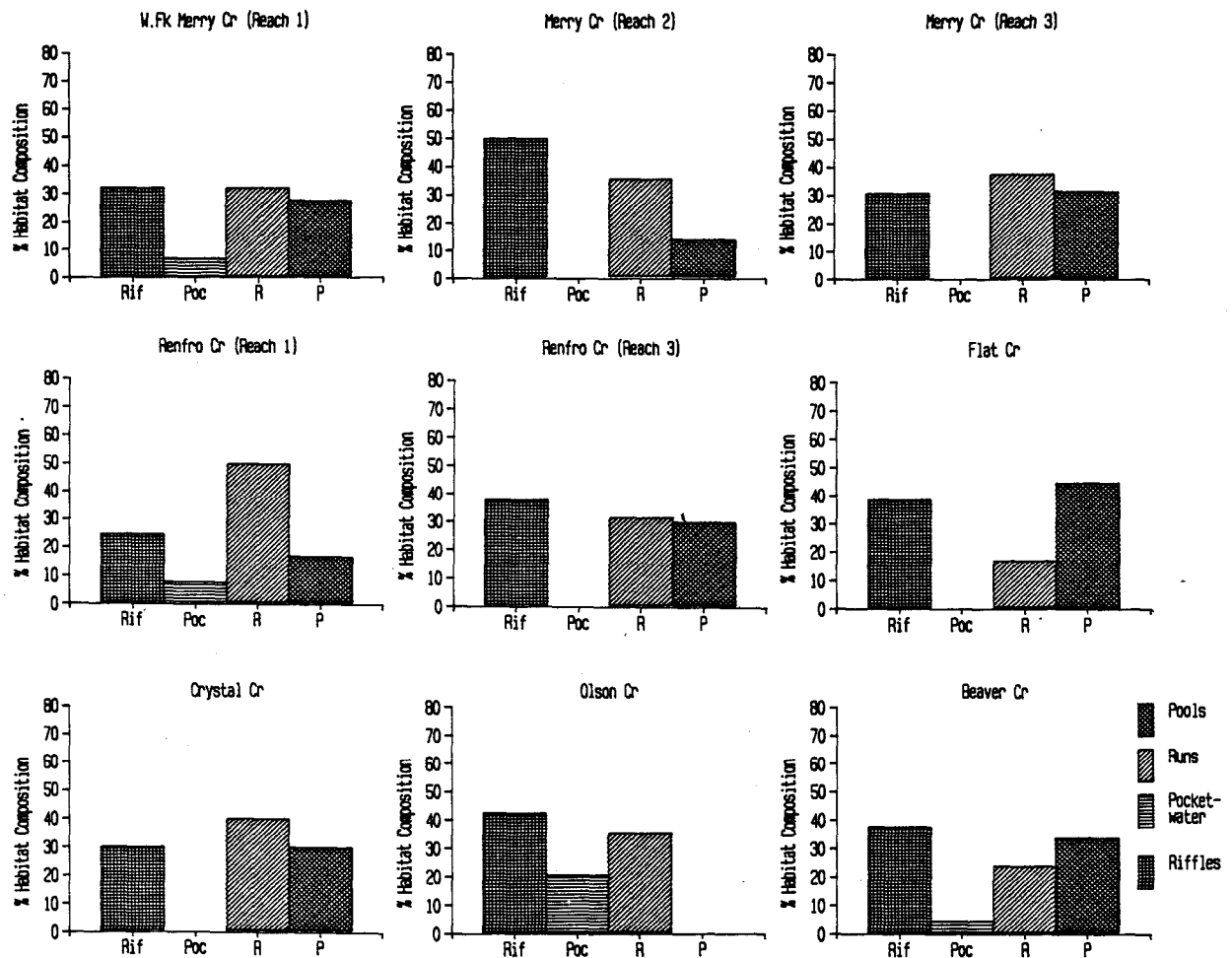


Appendix C, continued.



Pools
 Runs
 Pocket-water
 Riffles

Appendix C, continued.



Appendix D. Stream habitat survey summary for tributaries to the Coeur d'Alene, St. Joe, and St. Maries rivers, 1985 through 1987.

Stream	Reach	Date	Elevation start/end	Reach distance	Gradient (%)	R width	Surveyed length	Pool class (%)	Number spawning	P					Total
			(ft)	(ft)	R/max/min	(ft)	(ft)	1/ 2/ 3/ 4	sites	LOM	Bldr	UB	OV	other	
Coeur d'Alene River															
Bear Cr.	1	9/12/85	2,235/2,310	18,480	01/02/01	11	570	00/00/18/22	0	16	00	01	07	00	24
Brown Cr.	1	8/29/85	2,315/2,700	9,570	04/06/02	12	1,346	00/02/00/12	8	04	16	00	05	00	25
Coal Cr.	1	9/04/85	2,290/3,200	8,900	10/00/00	10	305	00/00/00/23	1	07	04	00	03	00	14
Cougar Gulch	1	9/23/85	2,240/2,640	22,176	02/03/02	17	2,110	01/09/12/08	1	10	02	00	05	00	17
E. Fk. Eagle Cr.	1	9/09/85	2,640/2,800	11,088	02/02/02	21	640	00/00/00/16	0	00	02	00	01	00	03
	2	9/09/85	2,800/3,400	24,288	02/00/00	20	622	00/00/09/03	1	05	01	00	00	00	06
W. Fk. Eagle Cr.	1	9/09/85	2,740/3,270	21,120	02/03/01	16	2,045	00/00/20/05	5	05	02	00	02	00	09
Evans Cr.	1	8/21/85	2,135/2,340	21,120	01/03/01	13	2,881	07/02/06/02	20	05	02	02	07	00	16
	2	8/21/85	2,340/2,550	9,380	05/05/05	12	778	04/00/06/00	3	05	13	04	12	00	34
	3	8/21/85	2,550/2,760	5,300	07/00/00	10	236	00/00/00/22	3	09	04	04	00	01	00
Fortier Cr.	1	8/21/85	2,130/2,165	7,650	01/02/01	9	1,965	14/28/17/11	19	13	01	07	24	01	46
Fourth of July Cr.	1	8/19/85	2,137/2,155	13,200	01/01/01	14	8,499	71/01/00/00	4	01	00	09	47	00	57
	2	8/19/85	2,155/2,256	10,560	01/00/00	14	1,021	01/29/37/00	0	04	01	00	26	00	31
French Gulch	1	9/25/85	2,150/2,260	9,500	01/00/00	6	641	00/08/30/03	0	01	00	03	39	00	43
	2	9/25/85	2,260/2,360	3,200	02/02/02	7	269	00/00/39/29	0	12	01	02	14	00	29
Graham Cr.	1	9/04/85	2,300/2,430	5,940	02/03/02	14	1,814	03/14/06/05	4	10	04	04	08	00	26

Appendix D, continued.

Stream	Reach	Date	Elevation	Reach	Gradient (%)	width	Surveyed	Pool class (%)				Number	Stream cover (%) ^a					
			start/end	distance				length	1/	2/	3/	4	spawning	LOM	Bldr Total	UB	OV	Other
			(ft)	(ft)	R/max/min	(ft)	(ft)				sites							
Coeur d'Alene River (cont.)																		
Grizzly Cr.		8/29/85	2,310/2,530	7,390	04/04/03	16	702	04/15/04/06				11	10	18	03	12	00	43
Lost Cr.	1	9/04/85	2,470/2,560	7,900	02/02/01	20	1,976	03/02/08/07				11	06	12	00	06	00	24
	2	9/04/85	2,560/2,680	5,940	02/00/00	16	535	00/00/07/05				3	26	00	02	07	00	35
E. Fk. Lost Cr.	1	9/04/85	2,560/2,780	8,850	04/08/02	13	990	00/00/11/00				7	14	21	04	19	00	58
Hat Cr.	1	9/04/85	2,610/2,920	7,590	02/02/01	5	247	00/16/24/02				3	15	00	20	32	00	67
Scott Cr.	1	9/29/85	2,250/2,520	5,280	02/03/01	7	680	00/00/00/13				6	17	04	01	26	00	48
Skeel Gulch	1	8/19/85	2,140/2,400	7,400	01/02/01.	5	897	00/02/00/34				10	07	02	01	15	00	25
Steamboat Cr.	1	8/08/85	2,250/2,310	7,920	01/02/01	27	4,550	00/06/07/07				18	01	10	00	08	00	19
	2	8/26/85	2,310/2,550	18,500	02/03/01	28	7,899	04/08/07/02				19	04	08	01	07	01	21
E. Fk. Steamboat Cr.	1	8/26/85	2,550/2,710	6,600	03/03/02.	18	2,526	02/02/00/07				10	11	05	01	15	00	32
W. Fk. Steamboat Cr.	1	8/29/85	2,550/2,760	9,240	03/05/01	16	1,316	00/06/09/03				10	10	14	01	03	00	28
Thompson Cr.	1	8/11/85	2,130/2,500	6,070	05/09/02	6	760	00/03/09/09				0	05	03	03	17	00	28
	2	8/11/85	2,500/2,630	4,330	05/05/05	5	270	00/00/11/07				0	09	05	00	08	00	22
W. Fk. Thompson Cr.	1	8/11/85	2,500/2,635	3,700	02/02/02	3	265	00/15/00/30				0	12	01	06	22	00	41
Willow Cr.	1	8/21/85	2,140/2,460	12,670	02/02/02	6	3,221	18/01/00/05				5	09	01	05	44	00	59

Appendix D, continued.

Stream	Reach	Date	Elevation	Reach	Gradient (%)	R	Surveyed	Number				Stream cover (%) ^a						
			start/end	distance		width		length	pool class (a)				spawning	cover (%) ^a				
			(ft)	(ft)		(ft)		(ft)	1/	2/	3/	4		LOM	Bldr	UB	OV	Other
St. Joe River																		
Benewah Cr.	1	7/09/86	2,128/2,160	3,050	02/02/01	17	701	16/26/05/00	0	13	10	05	03	00	31			
	2	7/14/86	2,160/2,540	18,277	02/03/02	21	2,851	00/02/05/02	6	00	36	00	00	00	36			
	3	7/15/86	2,540/2,773	28,431	01/01/01	18	1,834	24/05/21/20	3	06	02	06	11	03	28			
Bond Cr.	1	9/11/86	2,130/2,190	10,052	01/01/01	12	1,395	05/06/10/02	8	04	02	04	11	00	21			
Cherry Cr.	1	7/01/86	2,138/2,140	1,218	01/01/00	9	503	05/10/58/00	9	07	00	02	18	01	28			
	2	7/08/86	2,140/2,320	3,046	03/04/02	7	371	06/00/10/08	0	01	15	07	10	00	33			
Hugus Cr.	1	9/19/86	2,170/2,250	5,077	02/03/01	6	358	00/07/04/14	5	03	00	07	14	00	24			
Mica Cr.	1	8/27/86	2,226/2,555	16,043	01/02/01	25	532	00/00/20/02	2	00	16	00	00	00	16			
	3	9/19/86	3,020/3,060	4,874	02/02/01	15	1,187	00/00/04/05	0	01	06	05	02	00	14			
Rochat Cr.	1	8/13/87	2,135/2,520	11,088	03/04/02	8	150	03/00/00/13	7	07	09	05	03	00	24			
Street Cr.	1	7/03/86	2,123/2,300	10,966	02/04/02	11	821	03/13/02/06	10	06	13	04	02	00	25			
Thomas Cr.	1	7/30/86	2,138/2,340	4,061	01/02/01	7	640	00/05/03/02	0	01	06	09	15	00	31			
Trout Cr.	1	9/17/86	2,165/2,495	13,809	01/02/01	23	1,546	00/00/05/19	11	01	08	00	00	00	09			
St. Maries River																		
Alder Cr.	1	8/28/86	2,240/2,665	24,369	03/04/02	14	392	00/00/00/00	4	39	00	00	00	00	39			
	2	8/28/86	2,665/2,875	14,215	01/01/01	13	715	23/00/00/06	3	14	05	09	08	00	36			
Beaver Cr.	1	8/27/87	2,590/2,680	5,808	02/03/61	7	105	00/05/10/19	1	02	02	03	20	00	27			

Appendix D, continued.

Stream	Reach	Date	Elevation start/end (ft)	Reach distance (ft)	Gradient (%) R/max/min	x width (ft)	Surveyed length (ft)	Pool class (%)				Number spawning sites	Stream cover (%) ^a					
								1/	2/	3/	4		LOM	Bldr	UB	OV	Other	Total
St. Maries River (cont.)																		
Carlin Cr.	1	7/24/86	2,080/2,370	2,234	05/06/04	7	413	00/06/00/00				0	09	19	02	56	00	86
	2	7/24/86	2,370/3,360	12,997	07/08/06	6	159	31/09/00/00				0	12	18	10	16	00	56
Crystal Cr.	1	8/13/87	2,700/3,240	16,896	02/02/02	11	100	05/00/15/10				1	05	00	03	10	00	18
Flat Cr.	1	7/09/87	2,530/2,545	792	02/02/02	8	90	00/06/11/28				0	02	02	03	14	00	21
Merry Cr.	2	9/03/87	2,955/3,185	14,800	02/02/01	23	70	07/00/07/00				4	09	03	03	01	00	16
	3	9/03/87	3,185/3,420	5,000	04/04/03	12	80	13/06/13/00				13	18	00	02	06	00	26
W. Fk. Merry Cr.	1	9/03/87	2,945/2,955	800	03/04/02	14	75	07/07/07/07				0	13	05	00	08	00	26
Olson Cr.	2	9/04/87	2,800/3,440	14,784	03/03/02	15	70	00/00/00/00				7	01	19	02	02	00	24
Renfro Cr.	1	9/04/87	2,630/2,750	7,920	02/03/02	11	60	00/00/00/17				0	02	09	00	10	00	21
	3	8/28/87	2,840/3,580	15,840	04/06/03	7	170	00/06/09/15				9	18	00	03	14	00	35
Santa Cr.	1	8/12/86	2,585/2,805	44,880	01/01/01	17	1,340	19/20/29/08				5	01	13	01	05	00	20
Charlie Cr.	1	8/12/86	2,805/2,900	17,262	00/00/00	19	694	10/14/08/27				9	04	02	03	15	00	24
Thorn Cr.	1	7/24/86	2,110/2,160	5,077	01/01/01	15	612	00/00/13/02				0	02	05	01	02	01	11
	2	7/24/86	2,160/2,285	3,249	03/05/02	13	528	03/02/00/00				0	03	43	00	02	00	48

^aKey: LOM = large organic matter
 Bldr = boulder
 UB = undercut banks
 OV = overhanging vegetation
 Other = explained in Appendix B.

Appendix E. Minimum and maximum temperatures in the Coeur d'Alene, St. Joe, and St. Maries rivers and tributaries, 1985 through 1987.

Stream	Thermometer location	Date		Temperature °C
		Placed	Removed	Min/Max
Coeur d'Alene River				
Bear Creek	Near McCloud Hill	08-08-85	09-10-85	6.5/ 9.5
Brown Creek	Near mouth	08-08-85	09-10-85	10.0/13.0
Cougar Gulch	Near mouth	08-08-85	09-10-85	9.5/15.0
Evans Creek	Just above slackwater	08-08-85	09-12-85	8.0/23.0
Fortier Creek	Near lower bridge	08-08-85	09-12-85	9.0/18.0
Fourth of July Creek	Near Service Creek	08-08-85	09-10-85	9.5/15.0
French Gulch	Near lower bridge	08-08-85	09-10-85	10.0/19.0
Graham Creek	Near bridge	08-08-85	09-09-85	9.0/16.0
Grizzly Creek	Near bridge	08-08-85	09-10-85	8.5/19.5
Scott Creek	Near mouth	08-08-85	09-10-85	8.0/13.0
Skeel Gulch	Near bridge	08-08-85	09-10-85	10.0/16.0
Thompson Creek	Below confluence	08-08-85	09-11-85	7.0/23.0
Willow Creek	At powerline	08-08-85	09-12-85	11.5/20.5
St. Joe River				
St. Joe River	Railroad bridge near Falls Creek	06-29-87	10-07-87	6.0/24.0
St. Joe River	Shadowy St. Joe (slackwater)	06-29-87	08-31-87	20.0/21.0
St. Joe River	2.0 km upstream from St. Maries (slackwater)	06-29-87	08-31-87	17.0/23.5
Benewah Creek	Highway bridge	07-01-86	09-30-86	6.0/25.0
Benewah Creek	At 4th bridge	07-01-86	09-30-86	7.0/24.5
Producer Creek ^a	At 4th bridge	07-01-86	09-30-86	6.0/16.5
Hugus Creek	Near mouth	07-01-86	09-30-86	8.0/22.0
Mica Creek	Near mouth	07-01-86	09-30-86	6.0/21.0
Reeds Gulch	At highway culvert	07-01-86	09-30-86	8.0/10.5
Street Creek	At highway culvert	07-01-86	09-30-86	8.0/21.0
Thomas Creek	At highway culvert	07-01-86	09-30-86	6.0/20.0
Whittenburg Draw	At highway culvert	07-01-86	09-30-86	6.5/18.0
St. Maries River				
St. Maries River	Near Sportsmen's Access (slackwater)	06-29-87	10-07-87	6.0/24.5
St. Maries River	Lotus crossing	07-10-87	09-04-87	12.0/27.0
St. Maries River	Mashburn	07-10-87	09-04-87	12.0/28.0
St. Maries River	Metropolitan Bridge	07-10-87	09-04-87	8.0/24.5
M.Fk. St. Maries River	Just above Merry Creek	07-10-87	09-04-87	8.0/19.0
Carlin Creek	2nd bridge	07-01-86	09-30-86	5.5/18.0
Merry Creek	Near mouth	07-10-87	09-04-87	8.0/21.0
Renfro Creek	At highway bridge	07-10-87	09-04-87	7.0/24.0
Thorn Creek	Just above Canyon Creek	07-01-86	09-30-86	8.0/22.0
Canyon Creek	At highway culvert	07-01-86	09-30-86	6.0/19.0

^aAn unnamed tributary to Benewah Creek that we named Producer Creek.

Appendix F. Conductivities in tributaries to the Coeur d'Alene River,
1984 and 1985.

Location	Date	Micromhos/cm ³	Temp°C
Bear Cr.	08-08-85	42	11
Blue Lake Cr.	08-07-84	47	20
	08-08-85	52	11
Brown Cr.	08-09-84	102	21
	08-07-85	112	11
Bumblebee Cr.	08-08-84	84	21
Canyon Cr.	08-15-84	21	20
Clark Cr.	08-07-84	47	20
Coal Cr.	08-16-84	13	21
	08-07-85	17	8
Copper Cr.	08-15-84	20	20
Cougar Gulch	08-09-84	69	21
	08-07-85	76	14
E. Fk. Eagle Cr.	08-12-85	35	12
W. Fk. Eagle Cr.	08-12-85	40	14
Evans Cr.	08-07-84	27.5	20
	08-08-85	117	13
Fortier Cr.	08-07-84	46.5	20
	08-08-85	50	12
Fourth of July Cr.	08-12-85	90	10
French Gulch	09-05-84	118	25
	08-12-85	118	16
Gimlet Cr.	08-15-84	32	20
Graham Cr.	08-16-84	16	21
	08-07-85	19	11
Grizzly Cr.	08-09-84	84	21
	08-07-85	93	11
Latour Cr.	09-06-84	22	19
Little Tepee Cr.	08-09-84	47	21

Appendix F, continued.

Location	Date	Micromhos/cm ³	Temp°C
Lost Cr.	07-26-84	66	21
	08-20-85	71	11
E. Fk. Pine Cr.	09-05-84	62	25
Robinson Cr.	08-07-84	38.5	20
Rose Cr.	08-07-84	47	21
Scott Cr.	08-07-85	126	10
Skeel Gulch	08-12-85	53	12
Shoshone Cr.	07-26-84	17.5	21
Steamboat Cr.	08-09-84	59	21
	08-07-85	69	13
E. Fk. Steamboat Cr.	08-07-85	70	14
W. Fk. Steamboat Cr.	08-07-85	80	13
Thompson Cr.	08-07-84	57.5	20
	08-08-85	61	12
Willow Cr.	08-07-84	55	20
	08-08-85	48	15
Yellow Dog Cr.	07-26-84	17.5	21

Appendix G. Total drainage area for streams surveyed in the St. Joe, St. Maries, and Coeur d'Alene rivers.

Stream	Square miles	Square kilometers
St. Joe River		
Benewah Creek	52.76	136.76
Cherry Creek	8.03	20.81
Thomas Creek	3.29	8.53
Mercury Creek	4.40	11.41
Street Creek	7.90	20.48
Rochat Creek	9.33	24.18
Reeds Gulch	5.30	13.74
Wittenburg Draw	2.66	6.89
Bond Creek	26.10	67.65
Falls Creek	10.70	27.74
Trout Creek	20.47	53.06
Hugus Creek	12.02	31.16
Moose Creek	3.74	9.69
Bear Creek	8.73	22.63
Elk Creek	3.70	9.59
Mica Creek	41.02	106.33
St. Maries River		
Thorn Creek	32.30	83.72
Carmen Creek	3.30	8.55
Carlin Creek	3.16	8.19
Alder Creek	26.71	69.23
John Creek	25.70	66.62
Flat Creek	10.97	28.44
Soldier Creek	4.48	11.61
Santa Creek	73.29	189.98
Beaver Creek	8.42	21.83
Renfro Creek	17.48	45.31
Sheep Creek	3.59	9.31
Tyson Creek	12.73	33.00
Crystal Creek	8.18	21.00
Carpenter Creek	20.00	51.84
Olson Creek	9.16	23.74
Emerald Creek	36.55	94.74
Childs Creek	5.43	14.08
Blair Creek	2.48	6.43
Merry Creek	19.34	50.13
Coeur d'Alene River		
Thompson Creek	4.93	12.78
Blue Lake Creek	9.58	24.83
Cottonwood Creek	2.93	7.59
Willow Creek	5.92	15.35
Evans Creek	13.12	34.01
Clark Creek	3.47	8.99
Robinson Creek	6.17	15.99
Fortier Creek	8.93	23.15

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Appendix G, continued.

<u>Stream</u>	<u>Square miles</u>	<u>Square kilometers</u>
Coeur d'Alene River (cont.)		
Latour Creek	51.56	133.65
Skeel Gulch	3.76	9.75
Hunt Gulch	2.54	6.58
French Gulch	4.62	11.98
East Fork Pine Creek	30.69	79.55
Trapper Creek	7.04	18.25
Bumblebee Creek	5.62	14.57
Little Teepee Creek	2.56	6.64
Gimlet Creek	3.81	9.88
Copper Creek	13.73	35.59
Cougar Gulch	18.78	48.68
Steamboat Creek	41.28	107.00
Scott Creek	1.75	4.54
Coal Creek	3.30	- 8.55
Silver Creek	1.26	3.27
Graham Creek	9.32	24.16
Grizzly Creek	6.88	17.83
Brown Creek	5.66	14.67

JOB COMPLETION REPORT

State of: Idaho

Name: RIVER AND STREAM INVESTIGATIONS

Project No.: F-73-R-10

Title: North Idaho Streams Fishery Research

Subproject No.: IV

Study No.: IV

Job No.: 3. Fish Species and Stock Evaluation

Period Covered: March 1, 1987 to February 29, 1988

ABSTRACT

Extreme summer temperatures and lack of instream cover prevent a cutthroat trout fishery in the slackwater reaches of the St. Joe and St. Maries rivers. Other species of game fish that could withstand the temperature regime were discussed with regard to their desirability for introduction. Of foremost consideration are impacts that exotic species may have on other fisheries in the drainage, especially the native westslope cutthroat trout.

Lack of habitat in the form of cover and spawning substrate would limit the success of any game fish in the slackwater. We expect any introduced species to leave the slackwater area and seek out better habitat in riverine reaches upstream or lake environments downstream. We do not recommend introductions of channel catfish, smallmouth bass, or brown trout because these exotics may become widely distributed throughout the drainage and adversely impact other fisheries.

Tributaries to the Coeur d'Alene, St. Joe, and St. Maries rivers that are currently underseeded with cutthroat trout are named. Streams that show greatest potential for responding to seeding supplementation are recommended for such efforts. Care must be taken with any hatchery program to protect the genetic integrity of westslope cutthroat trout throughout the upper Spokane River drainage.

The catchable trout program is very successful, yet localized, in the three drainages studied. Increased harvest of hatchery trout may occur as strict harvest regulations are implemented for cutthroat trout. Trout harvest should be monitored and stocking rates changed as needed to provide

the desired return to the creel higher than 40X, with a 0.5 fish/h catch rate. Even spacial distribution of hatchery rainbow trout in the St. Joe and Coeur d'Alene rivers is recommended.

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INTRODUCTION

The 1986 to 1990 Fisheries Management Plan of the Idaho Department of Fish and Game (1986) states: "Native wild stocks of resident trout will receive priority consideration in all management decisions involving resident fish." Concerning the introduction of exotic species, the Plan states: "Non-native salmonids and warmwater game fish will not be introduced into waters where they adversely affect goals and objectives set for native...programs. However, suitable exotic species will be utilized to establish sport fisheries in habitat unsuited for native species, or where the introduced species can provide increased fishing opportunity without undue damage to existing species."

Three exotic species, (channel catfish Ictalurus punctatus, smallmouth bass Micropterus dolomieu, and brown trout Salmo trutta), with potential to provide fisheries in the slackwater reaches of the St. Joe and St. Maries rivers were evaluated. Largemouth bass Micropterus salmoides, already present in the system, was considered for expansion into slackwater reaches.

Guidelines are presented for supplemental seeding of cutthroat trout fry in underseeded tributaries.

The catchable rainbow trout program and cutthroat-rainbow trout hybridization problems are discussed. Guidelines are presented for stocking hatchery rainbow trout throughout the three drainages.

OBJECTIVE

To evaluate and recommend species or stocks of fish that will enhance the fisheries of the lower Coeur d'Alene, the lower St. Joe, and the St. Maries river systems.

RECOMMENDATIONS

Slackwater Fisheries

Lack of habitat is the major factor limiting fish populations in the lower St. Joe River downstream from St. Joe City and in the St. Maries River downstream from Lotus Crossing. Instream cover and spawning habitat is needed, but would be very difficult to create and stabilize against flood events. Introduction of coldwater species is not recommended because of high, summer water temperatures. Channel catfish would tolerate the temperature regime in the slackwater and should have little impact on other fisheries. We would expect channel catfish to seek more preferable habitat and not provide a fishery in the slackwater; therefore, we do not recommend introduction. There is limited potential for improvement of largemouth bass habitat in backwater sloughs within the slackwater reaches.

Riverine and Tributary Fisheries

1. We recommend continuation of the catchable rainbow trout stocking program in the Coeur d'Alene, St. Joe, and St. Maries rivers. Because harvest of catchable rainbow trout occurs near stocking sites, we also recommend wider distribution of these trout throughout the rivers. Recommended stocking sites on the lower Coeur d'Alene River are: Cataldo Mission, Interstate Highway 90 crossing, and near the mouth of the South Fork. Recommended stocking sites on the lower St. Joe River are: Aqua Park, Falls Creek, Calder, and Huckleberry Campground. Access limits wider distribution of trout in the St. Maries River. Return to the creel of catchable trout is high in all three rivers. With the implementation of more restrictive fishing regulations for cutthroat trout, higher exploitation of and increased demand for catchable trout could occur. Continued harvest data is needed to determine stocking rates necessary to provide higher than 40% return to the creel and a 0.5 fish/h catch rate.

2. We recommend that underseeded tributaries to the Coeur d'Alene, St. Joe, and St. Maries rivers be fully seeded with cutthroat trout fry. Fry supplementation is recommended for the following streams in each drainage:

Coeur d'Alene River: Cougar Gulch, Brown Creek, Evans Creek, Grizzly Creek, Lost Creek, and Steamboat Creek; Graham Creek and Latour Creek following brook trout eradication.

St. Joe River: Mica Creek; Hugus Creek following brook trout eradication.

St. Maries River: Carlin Creek, upper Merry Creek, and Renfro Creek; upper Charlie Creek following brook trout eradication.

We recommend 500 fry/100 m² be stocked in these streams, concentrated in the areas with the best habitat. Approximately 405,000 cutthroat trout fry would fully seed good quality habitat in the aforementioned streams.

3. Good sources for cutthroat trout broodstock are: French Gulch, Skeel Gulch, and Willow Creek in the Coeur d'Alene River drainage; Trout Creek in the St. Joe River drainage; and Flat and Soldier creeks in the St. Maries River drainage. Based on our trapping efforts, these streams could provide broodstock without severe impacts to cutthroat trout populations and they are trappable.

METHODS

Alternative fish species or stocks were evaluated, through a literature review, for suitability of introduction and adaptation to the lower Coeur d'Alene, the lower St. Joe, and the St. Maries rivers. Impacts to wild stocks were considered before recommendations were made. Habitat requirements were compared with existing habitat characteristics to determine fish suitability to the stream sections of concern.

DISCUSSION

The purpose for recommending introductions of exotic stocks or species of fish into the upper Spokane River drainage is to provide optimum sport fishing opportunities to anglers. Managing for native westslope cutthroat trout is a priority management objective throughout the upper Spokane River drainage. As exotic stocks or species of fish are considered for introduction into this drainage, great care must be taken to thoroughly evaluate possible repercussions to all of the present fisheries.

Pioneering by fish into areas outside of the boundaries of the present study sites is undesirable. Some of the aquatic communities outside of the study area have not been adequately studied to predict impacts of exotic introductions.

Slackwater Fisheries

Slackwater reaches of the St. Joe and St. Maries rivers provide a very short seasonal fishery for migratory trout. Slackwater is defined as the St. Joe River downstream from St. Joe City and the St. Maries River downstream from Lotus Crossing. No resident trout populations exist because of the absence of habitat and limiting summer temperatures. Many species of game fish could succeed in temperature conditions present in the slackwater reaches, and productivity has increased over the last 25 years (Falter, this publication (Appendix B)). However, fish require instream cover and structure for spawning and to provide adequate food production. Habitat improvements must accompany any introductions if successful and sustained fisheries are to be established within the slackwater reaches of the St. Joe and St. Maries rivers.

Channel Catfish

Channel catfish primarily inhabit moderate to swiftly flowing streams with gravel or rubble substrate, but have been found over sand and mud bottoms (Scott and Crossman 1973). Channel catfish spawn in late spring at temperatures of 24°C to 29.5°C, preferring temperatures higher than 27°C. Cover in the form of undercut banks, boulders, or large organic

matter is required for successful reproduction. Suboptimal water temperature is the suspected cause for low channel catfish recruitment to the fishery in the lower Snake River below Hells Canyon Dam (Bert Bowler, Idaho Department of Fish and Game, personal communication). Growth is minimal when temperatures drop below 21°C (Scott and Crossman 1973). Maturity is typically reached at age IV in northern populations with a 4-year-old channel catfish averaging 270 mm (Carlander 1969). Channel catfish planted in Cocolalla Lake, Idaho, in 1984 are growing at better than average rates with age III+ fish being 289 mm (Horner et al. 1987).

Channel catfish are typically omnivorous bottom feeders, but can be predacious on invertebrates and vertebrates. Yellow perch and various minnow species were important food for large channel catfish in Canada (Scott and Crossman 1973). Fish become more important in the diet when water is clear making sight feeding possible. Channel catfish consume large numbers of salmon and steelhead trout smolts in the Columbia River at temperatures of only 15° to 17°C (Thomas P. Poe, U.S. Fish and Wildlife Service, Columbia River Field Station, Cook, Washington, personal communication). The health of smolts eaten is questionable, however, because the majority of the predation occurs in the tailrace of McNary Dam. A concern in the St. Joe and St. Maries rivers would be possible predation by channel catfish on juvenile cutthroat trout.

Half of the channel catfish stocked in the St. Lawrence River, Quebec, Canada moved 16 to 63 km upstream and downstream (Scott and Crossman 1973). Warm summer temperatures in the St. Joe and St. Maries rivers may allow channel catfish stocked into slackwater reaches to expand their range. We must expect that the ultimate range of channel catfish would encompass the entire lower St. Joe River, including side channels and lakes from the slackwater into Lake Coeur d'Alene. A thermal barrier should prohibit channel catfish from becoming established throughout Lake Coeur d'Alene, but they may survive in the bays along the southern arm of the lake.

Brown Trout

Brown trout have habitat requirements similar to brook trout. Optimum temperature is 18° to 24°C, slightly higher than the <20°C preferred by brook trout (Scott and Crossman 1973). Brown trout spawn in the fall after brook trout, but use the same spawning habitat. Fish become important in the diet of brown trout larger than 300 mm. Nongame fish (suckers, dace, darters) were important in the diet of brown trout larger than 300 mm in Virginia (Garman and Nielsen 1982). Juvenile brook trout and minnows were important in the diet of brown trout in the Au Sable River, Michigan, but only limited numbers of brown trout juveniles were consumed (Alexander 1977). Rainbow trout constituted 66% of the brown trout diet during summer in Shadow Mountain Reservoir, Colorado (Sharpe 1962). Marshall and MacCrimmon (1970) found that brook and brown trout can coexist and provide good fisheries of both species, with brown trout controlling the population size of brook trout. They found more age classes of brown trout present than brook trout, presumably because of lower exploitability of brown trout. Catchability of brown trout is also low relative to cutthroat trout. Fausch and White (1981, 1986) observed juvenile brook trout

as the dominant competitor over brown trout in a laboratory stream, yet adult brown trout excluded adult brook trout from favorable positions in a Michigan stream. Vincent and Miller (1969) associated limited brown trout distribution in Colorado streams with altitude. Headwaters of tributaries to the Little South Poudre River were inhabited primarily by brook trout. Brown trout distribution expanded slowly upstream aided by increased fishing pressure on brook trout.

A brown trout introduction into the Rio Grande River resulted in a dramatic increase of the ratio of brown trout:cutthroat trout over a three-year period (<10:92 in 1969 versus 83:17 in 1970) (McCleskey 1972). In Willow Creek, a tributary to the South Fork Snake River where exploitation of cutthroat trout was high, brown and brook trout became the dominant species, even where habitat remained suitable for cutthroat trout (Corsi 1986).

Brown trout would be able to withstand all but the most extreme summer temperatures in the slackwater reaches of the St. Joe and St. Maries rivers; however, the rivers are often warmer than preferred by brown trout. Brown trout stocked in the St. Maries River in 1972 and 1973 were observed shortly afterward entering tributaries, apparently avoiding high river temperatures (Goodnight and Mauser 1974). Population density of brown trout is dependent on suitable instream cover (Lewis 1969; Lorz 1978). Therefore, lack of cover and associated food availability may limit the species' use of this area and encourage expansion into more suitable habitats within the drainage.

We would expect brown trout to expand their range and eventually inhabit the same reaches in the drainage as brook trout do now. Brown trout may also become established in Lake Coeur d'Alene, and with their piscivorous nature, may uncontrollably impact the kokanee fishery.

Smallmouth Bass

Smallmouth bass prefer temperatures between 20.3°C and 21.3°C and will actively feed when temperatures are above 8.5°C (Scott and Crossman 1973). In the north, spawning occurs in early summer in 16.1°C to 18.3°C water. Spawning habitat of sand, gravel, or rock near cover protection is required. Young smallmouth bass are planktivores and as they grow switch to insects, then crayfish, and fish.

Smallmouth bass are typically very territorial, but have been known to move up to 48 km (Scott and Crossman 1973). Smallmouth bass have become adapted to rocky windswept shores of large reservoirs where they once inhabited streams (Robbins and MacCrimmon 1974). If stocked in the slackwater reaches, we would expect smallmouth bass to expand their range to the entire lower St. Joe River, including side channels and lakes. Smallmouth bass may also become established in Lake Coeur d'Alene and could prey on young kokanee, or compete with kokanee for zooplankton prey.

Largemouth Bass

Contrary to the other species discussed thus far, largemouth bass are already present in the lower St. Joe and St. Maries rivers in small numbers and were caught during sampling efforts in slough areas of the slackwater reaches. A strong association between good cover and location of largemouth bass was observed during sampling. Largemouth bass are well established elsewhere in the drainage and provide a popular fishery in lakes adjacent to the lower St. Joe River. Habitat improvements in the form of instream structure and low overhanging and riparian cover in slough areas may concentrate numbers of largemouth bass, but potential for a fishery is very limited.

Riverine and Tributary Fisheries

Cutthroat Trout

We have quantitative information for both trout populations and habitat in tributaries. Some cutthroat trout populations are limited by habitat and some tributaries are underseeded. Recruitment would increase if habitat was improved and harvest decreased. Supplementing natural reproduction in some tributaries would increase recovery rates. Supplementation could be accomplished by (1) outplanting fry or fingerlings, or (2) transplanting wild mature fish from adequately seeded streams to underseeded streams. Regardless of the method, genetic integrity of the stock should be maintained.

In some streams, high densities of brook trout may inhibit cutthroat trout success. Cowley (1987) found that cutthroat trout fry stocking was most successful in streams with no fish present, followed by streams with only cutthroat trout present. Fry stocking was least successful when brook trout were present. Optimum densities of fry were obtained in tributaries to Priest Lake when 500 to 1,000 cutthroat trout/100 m² were stocked (Irving 1987).

We recommend that initial cutthroat trout supplementation be conducted in streams with the following criteria: (1) relatively poor current production of cutthroat trout, (2) evidence that a migratory population of cutthroat trout exists, (3) low densities of brook trout, (4) low summer temperatures ($\leq 19^{\circ}\text{C}$), and (5) rearing habitat not likely the primary limiting factor. We recommend 500 fry/100 m² be stocked in tributaries with good habitat (Appendix A).

Tributaries that are candidates for cutthroat trout supplementation are: Cougar Gulch, Brown Creek, Evans Creek, Grizzly Creek, Lost Creek, and Steamboat Creek in the Coeur d'Alene River drainage; Mica Creek in the St. Joe River drainage; and Carlin Creek, upper Merry Creek, and Renfro Creek in the St. Maries River drainage. Additional tributaries that could be supplemented following brook trout eradication are: Graham and Latour creeks in the Coeur d'Alene River drainage; Hugus Creek in the St. Joe River drainage; and upper Charlie Creek in the St. Maries River drainage. When included with habitat improvements (refer to Job 2), cutthroat trout supplementation would further enhance recovery of populations.

Good sources for cutthroat trout broodstock are: French Gulch, Skeel Gulch, and Willow Creek in the Coeur d'Alene River drainage; Flat and Soldier creeks in the St. Maries River drainage; and Trout Creek in the St. Joe River drainage. Big and Bond creeks may also be able to provide broodstock without impacting the population, but spawner escapement should be assessed first.

Rainbow Trout

Catchable rainbow trout are heavily fished where stocked in the three river systems. Return to the creel of hatchery-produced catchable rainbow trout was between 50% and 70% throughout all **three** rivers during the first six weeks of the seasons (1985 through 1987), but the harvest was very localized. We recommend wider spacial distribution of rainbow trout in the St. Joe River. In addition to current stocking at Avery, trout could be stocked at Aqua Park, the bridge crossing above Falls Creek, Calder, and Huckleberry Campground. In addition to stocking at Freeman Eddy, the Coeur d'Alene River could be stocked at Cataldo Mission boat launch, the bridge just above Interstate Highway 90, and the railroad bridge just above the South Fork. Hatchery rainbow trout are adequately distributed in the St. Maries River.

Hybridization between westslope cutthroat trout and rainbow trout varies, depending on the sympatric behavior of different stocks of each species (Behnke 1979; Bjornn and Liknes 1986). Populations in the Spokane River drainage, not having evolved with steelhead, may not possess isolating mechanisms that cutthroat trout in the Clearwater and Salmon rivers possess. Hybridization will most likely continue to affect the genetic integrity of westslope cutthroat trout in the Spokane River drainage because of sympatry of wild rainbow and native cutthroat trout populations. Considering the domestication of hatchery-produced rainbow trout, a low percentage would be expected to survive to maturity. Implications of cutthroat-rainbow trout hybridization on the quality of fisheries is not known (Nicholas et al. 1978). Hybrid vigor expressed in growth rates has been noted in this study.

Hatchery trout may or may not compete with wild trout in a stream (Thurrow and Bjornn 1978; Petrosky 1984; Petrosky and Bjornn 1984; Vincent 1984). Catchable trout programs are often necessary to relieve fishing pressure on native trout populations.

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A P P E N D I C E S

Appendix A. Areas in selected tributaries that may be stocked with 500 cutthroat trout fry/100 m².

Drainage, stream, & stocking area	Stocking area with brook trout removal
Coeur d'Alene River	
<u>Cougar Cr.</u> 2.5 km starting 0.3 km from mouth	
<u>Brown Cr.</u> lower 1.5 km	
<u>Evans Cr.</u> 1.2 km starting 0.6 km from mouth	
<u>Grizzly Cr.</u> lower 1.2 km	
<u>Lost Cr.</u> lower 8 km; lower 1.5 km of E. Fk.; lower Hat Cr.	
<u>Steamboat Cr.</u> lower 8 km; lower 1.2 km of forks	
<u>Graham Cr.</u>	lower 2 km
<u>Latour Cr.</u>	2.5 starting 1 km from mouth
St. Joe River	
<u>Mica Cr.</u> lower 2 km	1 km starting 2 km from mouth
<u>Hugus Cr.</u>	lower 1 km
St. Maries River	
<u>Carlin Cr.</u> lower 0.6 km	
<u>Merry Cr.</u> 0.6 km below and above Mann Cr.	
<u>Renfro Cr.</u> lower 1.5 km	
<u>Charlie Cr.</u>	1.2 km starting 0.5 km from mouth

Appendix B. ST. JOE AND ST. MARIES RIVERS LIMNOLOGY UPDATE - 1987

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In the late summer and fall of 1987, the Idaho Department of Fish and Game (IDFG) and personnel from the Department of Fish and Wildlife, University of Idaho (UI) cooperated in the generation of a limited set of limnological data on the lower St. Joe and St. Maries rivers, Benewah County, Idaho. The two objectives of this effort were:

- * To compare the limnological status of these river reaches with conditions described on the lower St. Joe and St. Maries rivers by Davis (1961); and,
- * To evaluate the apparent trophic status of these reaches from the standpoint of fish support.

Two joint trips were made to the study areas.

1. On 31 August 1987 David Hallock (UI), Mike Mahan (IDFG), and Cindy Robertson (IDFG) sampled the four study sites selected to duplicate the sites sampled by Davis in 1960. Conditions were judged representative of summer conditions.

2. On 13 October 1987 Mike Falter (UI), Mike Mahan, and Bill Horton (IDFG) sampled the above four sites. These were judged to be representative of fall conditions.

Appendix B, continued.

SITE LOCATIONS

M - St. Maries River, about 0.3 km upstream from St. Maries. The site is just below a right-hand bend.

5 - St. Joe River, about 4 km above St. Maries. The site is adjacent to the Mueller Ranch.

3 - St. Joe River, about 2 km below St. Maries. The site is approximately 300 m above Cherry Bend Park.

2 - St. Joe River, about 4 km below St. Maries. The site is 91 m below Mission Point Landing.

In August, several calm, hot (approximately 18°C) days preceded the sampling. Both rivers were clear and green following a low-runoff spring and sustained low flow through the summer. Substrate below the thalweg was fine material, mostly clay. On either side of the thalweg, sediments changed to fine sands to sandy loams on the banks except for boulders at the railway embankments or bridge fills. Mid-channel macrophytes were not observed. Shoreline macrophytes were sparse except for the lower St. Joe River site. Riparian vegetation was primarily overhanging shrubs and trees with more grasses at the lower site. Riparian conditions were judged comparable to Davis (1961) except for more evidence of wave erosion at the lower site. October sampling was preceded by a mild, dry fall with little precipitation.

Appendix B, continued.

August Habitat

In August the St. Joe River attained a surface temperature of 21.7 °C with slight warming on the banks at the lower site. Below 5 m, temperatures were 16 to 17 °C. The St. Maries River was slightly cooler (Table 19). Dissolved oxygen in the 8 to 9 mg/I range (approximately 90% saturation) in both rivers with some supersaturation seen at the lower site. All sites showed some oxygen depletion down to 3 to 6 mg/I (approximately 30% saturation in deeper waters). Oxygen depletion was greatest in the St. Maries River. Conductivity values were about 60 umho in surface waters with increases (indicating significant vertical stratification and lack of complete top to bottom mixing) towards the bottom. Secchi transparency was approximately 3 m in the St. Maries River and lower St. Joe River site, reduced from the 5.3 m in the upper St. Joe River. Water turbidity was low (about 1 to 2 NTU) with no trends between sites. Alkalinity was in the mid-30 mg/I range, again with no significant trends. Acid-base balance as measured by pH was 7.4 to 7.7.

Plant nutrient levels were indicated by the nitrate, Kjeldahl nitrogen (a measure of organic nitrogen), and total phosphorus concentrations in the water (Table 20). The two-way replication of our samples (3x3) ensures a solid base for future comparison. Summer nitrate was 9 to 28 ug/l with high values in the St. Maries River and St. Joe River immediately below St. Maries. St. Maries River samples were highest, followed next by the site immediately downstream from St. Maries. These values indicate low productivity. Kjeldahl nitrogen was .16 to .23 mg/i and total phosphorus was 0.11 to .023 mg/I, all values indicating a low nutrient base but not "nutrient-starved".

Appendix B, continued.

The above conditions were all similar to those described by Davis (1961) except for temperature and oxygen. We encountered a significant degree of both temperature and oxygen stratification at all sites. Davis found essentially none. His- study year was a higher flow year than 1987; this could have accounted for the difference. That conclusion is likely, since pH and alkalinity between the two years were comparable. Real productivity differences between the years would have shown up in those latter parameters. Davis did not measure plant nutrients.

October Habitat

By October 1987 water temperatures had dropped to less than 10 °C at all sites except for the lower St. Joe River site which had temperatures to 13.3 °C at the surface. Oxygen concentrations were near saturation except for 70% saturation persisting in the deep waters at the lower site. Conductivity was higher than August at the lower site and in deep waters in general, indicating prolonged poor mixing top to bottom in the water column. Nitrate nitrogen nearly doubled in the October samples at sites other than the upper St. Joe River; Kjeldahl nitrogen and total phosphorus were little changed from August.

Biota

Zooplankton was sampled by a 20-liter clear plastic Schindler sampler; Benthos was sampled by four Ponar .dredges per site; and phytoplankton was sampled by Kemmerer bottle.

Appendix B, continued.

Zooplankton in the St. Joe River dramatically increased downstream from a site average of 0.7 organisms/l at the upper site to 5.1 organisms/l below St. Maries and 20.9 organisms/l at Mission Point. St. Maries River zooplankton averaged 37.6 organisms/l. October numbers were generally higher than in August (Tables 1 through 9). The all-station average number in August was 5.0 zooplankton/l in the St. Joe River and 5.1 zooplankton/l in the St. Maries River. The October average was 12.9 zooplankton/l in the St. Joe River and 70.2 zooplankton/l in the St. Maries River. In comparison, Davis found a St. Joe River average of 0.6 zooplankton/l in August and 0.3 zooplankton/l in October. His St. Maries River average was 0.8 zooplankton/l over the season. Our composition was dominated by Boxminia and Ceriodaphnia as was Davis' in that order with the exception that he also found Daphnia and Alonella (both taxa absent in 1987). The density increase in zooplankton from 1960 to 1987 was striking.

Benthos composition was relatively sparse with 8 to 10 major taxonomic groups represented at each site (Tables 10 through 18). Four Ponar dredge replicates were taken at each site, but a dredge sample often had no organisms present, especially from high-sand content samples. Composition was dominated by oligochaetes, hydracarinids, chironomids, tabanids, elmids, beetles, trichoptera, hirudinea, and sphaeriid clams. These were similar to Davis' findings except that we found no amphipods. The St. Maries River site was notable in that we found large numbers of unionid clams there. Davis recorded no unionid or sphaeriid clams at all.

Benthos wet weights on the St. Joe River averaged 0.07, 0.32, and 0.22 mg/m² from upstream to downstream (14.38 mg/m² in the St. Maries River) for an overall backwater average of 3.75 mg/m². Davis found an overall backwater average of 1.10 mg/m². In the St. Joe River, 1987 biomass

Appendix B, continued.

declined slightly from August to October. Numbers increased from August to October in the St. Maries River but standard deviations indicated that was probably not significant.

Periphyton (attached benthic algae) growths in St. Joe River backwater were measured as per Davis (1961) and also to obtain biomass and chlorophyll a estimates. The glass slides we set out over the incubation period suffered heavy losses from wave action and water level lowering in the low flow year of 1987. The St. Joe River sites 2 and 5 were comparable to Davis' results; numbers were similar, but no conclusions could be drawn (Table 21). To obtain some periphyton data, we sampled three replicate areas from submerged portions of the wooden support stakes. That biomass data showed a strong trend of increasing productivity upstream to downstream (0.58, 1.00, and 3.61 mg/m²; 5.05 mg/m² in the St. Maries River). Chlorophyll a likewise increased from 10.8, 18.0, to 26.1 mg/m² from upstream to downstream (16.7 mg/m² in the St. Maries River). The trend of increasing productivity downstream (500% biomass increase) was very pronounced. Lower St. Joe River sites' periphyton ranked as very productive when compared to regional lakes' attached algae data.

Phytoplankton composition was dominated by Dinobryon, Gomphonema, Amphora, Scenedesmus, and Nostoc. Cryptanonas and the filamentous green Ulothrix dominated the October community. Davis reported Dinobryon also as the August dominant with Amphora as a subdominant, but he also found Synedra and Asterionella in large numbers. He (erroneously, I believe) reported phytoplankton concentrations averaging 0.058 organisms/ml in the St. Joe backwater, compared to our all-site average of 276 organisms/ml in 1987. I believe it is more likely that he erred in reporting, and his counts actually averaged 58 organisms/ml. That assumption would still render the 1987 counts about 375% higher than the 1960 counts.

Appendix B, continued.

Plankton chlorophyll a averaged 3.85 ug/l in the St. Joe backwater in August 1987. This is considered to be a moderately productive (mesotrophic) level for a lake and fairly high for a river.

CONCLUSIONS

It is obvious that the St. Joe River backwater basic productivity has increased dramatically from 1960. The year 1987 was a low flow year, so apparent 1987 productivity was high for that reason, to some extent. Nevertheless, a higher level of biological productivity in 1987 was indicated by:

- * pronounced deep water oxygen depletion
- * much higher zooplankton concentrations
- * disappearance of Daphnia in 1987
- * higher benthos biomass in 1987
- * much higher phytoplankton numbers in 1987
- * mesotrophic summer levels of chlorophyll a
- * very high periphyton accumulation rates in the lower St. Joe River

As in 1960, river bottom scouring and the continually increasing wave action on the shorelines combine to limit physical habitat diversity. Any available off-bottom substrate is rapidly colonized by primary and secondary producers. Despite the riverine system, nutrient and organic loading is high enough to produce a moderate production plankton community. This trend is even more pronounced from upstream to downstream sites. Provision of shoreline stabilization structures which would also provide an underwater reef effect would undoubtedly help to channelize this plankton and attached production to usable fish biomass, especially in the lower reaches.

Appendix B, continued.

LITERATURE CITED

Davis, S.P. 1961. A limnological survey of the backwater of the lower St. Joe River, Idaho. Master's thesis, University of Idaho, Moscow.

Appendix B, continued.

TABLE 1 ZOOPLANKTON IN THE ST. JOE RIVER (SITE 2), 31 AUGUST, 1987

SPECIES	0	!/L	SAMPLE DRY WT. E	SAMPLE ASHED WT.B	DRY WT. PER LITER
CERIODAPHNIA					
RETICULATA	66	1.1			
POLYPHEMIS					
PEDICULUS	4	0.06			
LEPTODORA					
KINDTI	1	0.01			
BOSMINA					
LONGIROSTRIS	82	1.36			
NAUPLII	21	0.35			
HYDRACARINA	1	0.01			
COPEPODA					
CYCLOPOID					
TROPOCYCLOPS PRESINUS	174	2.9			
	AUG. TOTAL	5.81	0.0028	.0005	.00005

VOL. FILTERED - 3 X 20L
 X SUBSAMPLED - 100
 (NOTE: HEAVY VOLVOX)

FILTER WEIGHT - 1.57792
 DRY WEIGHT - 1.58076
 ASHED WEIGHT - 1.57843

Appendix B, continued.

TABLE 2. ZOOPLANKTON IN THE ST. JOE RIVER (SITE 2), 13 OCTOBER, 1987.

SPECIES	!	!/L	SAMPLE DRY WT. g	SAMPLE ASHED WT. g	DRY WT. PER LITER
CERIODAPHNIA	40	0.5			
POLYPHEMUS	28	0.35			
BOSMINA	2697	33.712			
HYDRACARINA	2	0.025			
COPEPODA					
CALANOID					
EPISCHURA	5	0.0625			
CYCLOPOID					
TROPOCYCLOPS	121	1.5125			
	OCT. TOTAL	36.16	0.0075	0.0033	0.00013

	SITE MEAN	20.97	0.00515	0.0019	0.00009
VOL. FILTERED - 4 X 20L		FILTER WEIGHT - 1.61832			
X SUBSMIPLED 100		DRY WEIGHT - 1.62584			
(NOTE: VOLVOX AND		ASHED WEIGHT - 1.62158			
APANIZOMENON ALSO PRESENT)					

Appendix B, continued.

TABLE 3. ZOOPLANKTON IN THE ST. JOE RIVER (SITE 3), 31 AUGUST, 1987.

SPECIES	/	6/L	SAMPLE DRY WT.g	SAMPLE ASHED WT.g	DRY WT. PER LITER
COPEPODA					
CALANOID					
EPISCHURA	2	0.16			
CYCLOPOID					
TROPOCYCLOPS	37	0.30			
CERIODAPHNIA					
RETICULATA	23	0.19			
BOSMINA	678	5.65			
NAUPLII	5	0.41			
POLYPHEMUS	4	0.03			
CHIRONONIDAE	10	0.08			
OLIGOCHAETA	14	0.11			
OSTRACODA	14	0.11			
SIDA					
ERYSTALLINA	2	0.01			
	AUG. TOTAL	7.75	0.42819	0.43471	0.00357
VOL. FILTERED - 120L	FILTER WEIGHT - 1.59589				
% SUBSAMPLED - 100	DRY WEIGHT - 1.161770				
	ASHED WEIGHT -1.161180				

Appendix B, continued.

TABLE 4. ZOOPLANKTON IN THE ST. JOE RIVER (SITE 3), 13 OCTOBER, 1987.

SPECIES	8 / 1		SAMPLE DRY WT.g	SAMPLE ASHED WT.g	DRY WT. PER LITER
COPEPODA					
CALANOID					
EPISCHURA	2	0.02			
CYCLOPOID					
TROPOCYCLOPS	54	0.67			
CERIODAPHNIA	12	0.15			
RETICULATA					
BOSMINA	102	1.27			
NAUPLII					
POLYPHEMUS	8	0.1			
CHIRONOMIDAE					
OLIGOCHAETA					
OSTRACODA	1	0.1			
SIDA					
ERYSTALLINA					
EXURIA					
DAPHNIA SPP.					
EXUVIUM	1	0.1			
HYDRACARINA	1	0.1			
LEPTODORA					
	OCT. TOTAL	2.51	0.0072	0.0026	0.00009

	SITE MEAN	5.13	0.217695	0.218655	0.00183
VOL. FILTERED - 4X20L	FILTER WEIGHT -.157659				
(1 FROM EACH SIDE,	DRY WEIGHT - 1.58377				
2 FROM MIDDLE)	ASHED WEIGHT - 1.57923				
X SUBSAMPLED - 100					

Appendix B, continued.

TABLE 5. ZOOPLANKTON IN THE ST. JOE RIVER (SITE 5), 31 AUGUST, 1987.

SPECIES	0	I/L	SAMPLE DRY WT.g	SAMPLE ASHED WT.g	DRY WT. PER LITER
COPEPODA					
CALANOID					
EPISCHURA	1	0.00			
CYCLOPOID					
TROPOCYCLOPS	30	0.25			
CERIODAPHNIA	9	0.07			
RETICULATA					
BOSMINA	103	0.85			
NAUPLII	3	0.02			
POLYPHEMUS					
CHIRONOMIDAE	1	0.00			
OLIGOCHAETA					
OSTRACODA					
SIDA					
ERYSTALLINA	18	0.15			
EXURIA	1	0.00			
DAPHNIA SPP.					
AUG. TOTAL	1.34		0.0011	0.00017	0.000009

VOL. FILTERED - 6 x 20L
 % SUBSAMPLED - 100
 (NOTE - HEAVY APHANIZOMENON)

FILTER WEIGHT - 1.60707
 DRY WEIGHT - 1.60817
 ASHED WEIGHT - 1.60690

Appendix B, continued.

TABLE 6. ZOOPLANKTON IN THE ST. JOE RIVER (SITE 5), 13 OCTOBER, 1987.

	0	#/L	SAMPLE DRY WT.g	SAMPLE ASHED WT.g	DRY WT. PER LITER
CERODAPHNIA	2	0.02			
BOSMINA	3	0.03			
COPEPODA					
CALANOID					
EPISCHURA	1	0.01			
CYCLOPOID					
ALL IMMATURES	6	0.07			
OCT. TOTAL		0.13	0.0028	0.0008	0.00003
SITE MEAN		0.73	0.00195	0.000485	0.0000195
VOL. FILTERED - 4 X 20L	FILTER WEIGHT - 1.61833				
% SUBSAMPLED - 100	DRY WEIGHT - 1.62109				
(NOTE MUCH SEDIMENT)	ASHED WEIGHT - 1.61917				

Appendix B, continued.

TABLE 7. ZOOPLANKTON IN THE ST. MARIES RIVER, 31 AUGUST, 1987.

SPECIES	0	#/L	SAMPLE DRY WT.g	SAMPLE ASHED WT.g	DRY WT. PER LITER
CERIODAPHNIA	77	1.28			
BOSMINA	148	2.46			
NAUPLII	1	0.01			
OSTRACODA	51	0.85			
POLYPHEMUS	9	0.15			
CHIRONOMIDAE	3	0.05			
LEPTODORA	3	0.05			
EXUVIUM	1	0.01			
OLIGOCHAETA	1	0.01			
COPEPODA					
CALANOID					
EPISCHURA	1	0.01			
CYCLOPOID					
EUCYCLOPS AGILIS	14	0.23			
	AUG. TOTAL	5.11	0.0021	0.0003	0.00003

VOL. FILTERED - 3 X 201.
(NOTE - MUCH VOLVOX)

FILTER WEIGHT - 1.61957
DRY WEIGHT - 1.62165
ASHED WEIGHT - 1.61983

Appendix B, continued.

TABLE 8. ZOOPLANKTON IN THE ST. MARIES RIVER, 13 OCTOBER, 1987.

SPECIES	8	6/1	SAMPLE DRY WT.g	SAMPLE ASHED WT.g	DRY WT. PER LITER
COPEPODA					
CALANOID					
EPISCHURA	108	5.4			
CYCLOPOID					
TROPOCYCLOPS	347	17.3			
CERIODAPHNIA	308	3.85			
RET I CUUTA					
BOSMINA	2928	36.6			
NAUPLII	3	0.03			
POLYPNEMUS	551	6.88			
CMIRONOMIDAE					
OLIGOCHAETA	1	0.01			
OSTRACODA	9	0.11			
SIDA					
ERYSTALLINA					
EXURIA					
DAPHNIA SPP.					
EXUVIUM	3	0.03			
HYDRACARINA					
LEPTODORA	2	0.02			
	OCT. TOTAL	70.2	0.009	0.002	0.0001
	SITE MEAN	37.6	0.00555	0.00115	0.000065
VOL. FILTERED - 4 X 20L					
% SUBSAMPLED - 100					
FILTER WEIGHT - 1.60517					
DRY WEIGHT - 1.61446					
ASHED WEIGHT - 1.60677 (
SOME VOLVOX)					

Appendix B, continued.

TABLE 9. SUMMARY ZOOPLANKTON FROM THE ST. JOE AND ST. MARIES RIVERS AUGUST-OCTOBER, 1987.

SITE		TOTAL COUNT	DRY WT.	ASHED WT.	WT. PER LITER

ST. JOE	AUG.	5.81	0.0028	0.0005	0.00005
#2					
	OCT.	36.1	0.0075	0.0033	0.00013
	SITE MEAN (AUG. AND OCT.)	20.9	0.00515	0.0019	0.00009

ST. JOE	AUG.	7.75	0.42819	0.43471	0.00357
#3					
	OCT.	2.51	0.0072	0.0026	0.00009
	SITE MEAN (AUG. AND OCT.)	5.13	0.21769	0.218655	0.00183

ST. JOE	AUG.	1.34	0.0011	0.00017	0.000009
#5					
	OCT.	0.13	0.0028	0.0008	0.00003
	SITE MEAN (AUG. AND OCT.)	0.73	0.00195	0.000485	0.0000195

ST. MARIES	AUG.	5.11	0.0021	0.0003	0.00003
	OCT.	70.2	0.009	0.002	0.0001
	SITE MEAN (AUG. AND OCT.)	37.6	0.00555	0.00115	0.000065

Appendix B, continued.

TABLE 10. BENTHOS IN THE ST. JOE RIVER (SITE #2), 31 AUGUST, 1987.

TAXA	#'S						#'S						COMBINED SITES MID AND RB			
	SITE-MID			STD. MEAN DEV			SITE-RB			STD. MEAN DEV.			STD. MEAN DEV.		WET WGHT.	DRY WGHT.
	A	B	C	D			A	B	C	D						
CHIRONOMI	0	1	1	1	0.7	0.4	0	4	2	6	3	2.23	1.85	0.91	0.00646	0.00142
CERATOPOG	0	1	0	0	0.25	0.43	0	0	0	0	0	0	0.12	0.21	NO METWGHT	0.00001
CHAOBORID	0	1	0	0	0.25	0.43	0	0	0	0	0	0	0.12	0.21	NO METWGHT	0.00006
TABANIDAE	0	0	0	0	0	0	0	1	0	2	0.75	0.82	0.37	0.41	0.065	0.01161
DIPTERAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ELMIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HALIPIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SIPHONUR	0	0	0	0	0	0	0	1	0	0	0.25	0.43	0.12	0.21	0.0016	0.00096
LEPTOCERI	0	0	0	0	0	0	0	2	0	1	0.75	0.82	0.37	0.41	0.01268	0.00175
PHRYGANEI	0	0	0	0	0	0	0	0	0	1	0.25	0.43	0.12	0.21	0.0018	0.00038
BRACHYCEM	0	0	3	0	0.75	1.29	0	0	0	0	0	0	0.37	0.64	NO METWGHT	NO DRYMET
COENAGRIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HYDROPTIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLYCENTR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LIMNEPHIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OLIGOCHAE	0	0	2	0	0.5	0.86	0	2	4	4	2.5	1.65	1.5	0.39	0.01035	0.00244
HIRUDINIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAMMARIDA	0	0	0	0	0	0	0	3	0	8	2.75	3.26	1.37	1.63	0.0018	0.00039
DAPHNIDAE	0	0	0	0	0	0	0	0	1	0	0.25	0.43	0.12	0.21	NO METWGHT	0.00006
ASELLIDAE	0	0	0	0	0	0	0	1	0	0	0.25	0.43	0.12	0.21	0.00332	0.00107
SPHAERIID	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNIONIDAE	0	1	0	12	3.25	5.06	0	0	0	0	0	0	1.62	2.53	0.02677	0.01237
PLANORBID	0	0	0	0	0	0	4	5	0	1	2.5	2.06	1.03	1.03	0.10662	0.0433
HYDRACARI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SIALIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	0	4	6	13	5.7	8.49	4	19	7	23	13.2	12.6	9.25	9.28	0.2364	0.07582

Appendix B, continued.

TABLE 11. BENTHOS IN THE ST. JOE RIVER (SITE #2), 13 OCTOBER, 1987.

TAXA	COMBINED SITES MID AND RB																
	SITE-MID				STD. MEAN DEV		SITE-RB				STD. MEAN DEV.		STO. MEAN DEV.		WET WGHT.	DRY WGHT.	
	B	C	D				A	B	C	D							
CHIRONOMIDAE	1	0	15	0	4	6.36	3	15	2	8	7	5.14	5.5	0.60	0.045	0.00613	
CERATOPOGONIDAE	0	0	2	0	0.5	0.86	0	0	0	0	0	0	0.25	0.43	NOWETWGHT	0.00097	
CHAOBORIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TABANIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
DIPTERAN PUPA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ELMIDAE	0	0	1	0	0.25	0.43	0	0	0	0	0	0	0.12	0.21	NOWETWGHT	0.00016	
HALIPIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NOWETWGHT	0.00081	
SIPHONURIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
LEPTOCERIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
PHRYGANEIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
BRACHYCENTRIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
COENAGRIONIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
HYDROPTILIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
POLYCENTROPODIDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
LIMNEPHILIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
OLIGOCNAETA	2	2	0	0	1	1	6	0	5	62	18.2	25.3	9.62	12.1	0.12636	0.02999	
HIRUDINIA	0	1	0	0	0.25	0.43	0	0	0	1	0.25	0.43	0.25	0	0.00389	0.00072	
GANURIDAE	0	0	0	0	0	0	1	6	0	5	3	2.54	3	1.27	0.00411	0.00097	
DAPHNIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ASELLIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SPHAERIIDAE	0	0	10	0	2.5	4.33	0	0	0	0	0	0	1.25	2.16	0.03127	0.00007	
UNIONIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
PLANORBIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
HYDRACARINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SIALIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTALS	3	3	28	0	8.5	13.4	10	21	7	77	28.5	33.4	20	16.8	0.21063	0.03982	
COMBINED SITE AVERAGES AUGUST AND OCTOBER													-----				
													14.6	13	0.224	0.058	

Appendix B, continued.

TABLE 12. BENTHOS IN THE ST. JOE RIVER (SITE #3), 31 AUGUST, 1987.

TAXA	S'S						8'S						COMBINED SITES MID AND RB			
	SITE-MID			STD. MEAN DEV			SITE-RB				STD. MEAN DEV.		STD. MEAN DEV.	WET WGHT.	DRY WGHT.	
	A	B	C	D			A	B	C	D						
CHIRONOMIDAE	1	5	3	1	2.5	1.65	17	1	2	7	6.75	6.33	4.62	2.34	0.02365	0.00611
CERATOPOGONIDAE	0	0	0	0	0	0	0	0	1	0	0.25	0.43	0.12	0.21	NOWETWGHT	0.00001
CHAO80RIDAE	0	3	0	0	0.75	1.29	0	0	0	0	0	0	0.37	0.64	NOWETWGHT	0.00016
TABANIDAE	0	0	0	0	0	0	0	0	0	2	0.5	0.86	0.25	0.43	0.08954	0.00359
DIPTERAN PUPA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ELMIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HALIPIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SIPHONURIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEPTOCERIDAE	0	0	0	0	0	0	3	0	1	0	1	1.22	0.5	0.61	0.08935	0.0005
PHRYGANEIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BRACHYCENTRIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COENAGRIONIDAE	0	0	0	0	0	0	4	0	1	0	1.25	1.63	0.62	0.81	0.094%	0.00032
HYDROPTILIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLYCENTROPODIDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LIMNEPHILIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OLIGOCHAETA	12	32	16	11	17.7	8.43	19	39	13	10	20.2	11.2	19	1.43	0.08551	0.01371
HIRUDINIA	0	1	0	0	0.25	0.43	0	0	0	0	0	0	0.12	0.21	0.0009	0.00014
GAMMARIDAE	0	0	0	0	0	0	1	0	1	0	0.5	0.5	0.5	3.26	0.00308	0.00026
DAPHNIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ASELLIDAE	0	0	0	0	0	0	1	0	0	0	0.25	0.43	0.12	0.21	0.0015	0.0001
SPHAERIIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNIONIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PLANORBIDAE	0	0	0	0	0	0	4	0	1	1	1.5	1.5	0.75	0.75	0.08981	0.01513
HYDRACARINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SIALIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	13	41	19	12	21.2	11.8	49	40	20	20	32.2	24.2	27	10.9	0.4783	0.04003

Appendix B, continued.

TABLE 13. BENTHOS IN THE ST. JOE RIVER (SITE 83), 13 OCTOBER, 1987.

TAXA	S'S					I'S					COMBINED SITES MID AND RB			
	SITE-MID				STD. MEAN DEV		SITE-RB				STD. MEAN DEV.		STD. WET MEAN DEV. WGT.	DRY WGHT.
	B	C	D			A	B	C	D					
CHIRONOMIDAE	3	8	1	0	3 3.08	14	74	0	12	25 28.7		14 12.8	0.04042	0.00586
CERATOP000NIDAE	0	0	0	0	0 0	2	16	0	0	4.5 6.68		2.25 3.34	0.00039	0.00032
CHAOBORIDAE	0	1	0	0	0.25 0.43	0	0	0	0	0 0		0.12 0.21	0.00095	0.00008
TABANIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
DIPTERAN PUPA	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
ELMIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
HALIPIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
SIPHONURIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
LEPTOCERIDAE	0	0	0	0	0 0	0	1	0	0	0.25 0.43		0.12 0.21	0.00062	0.00003
PHRYGANEIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
BRACHYCENTRIDAE	0	0	0	0	0 0	0	0	1	0	0.25 0.43		0.12 0.21	0	0
COENAGRIONIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
HYDROPTILIDAE	0	0	0	0	0 0	0	1	0	0	0.25 0.43		0.12 0.21	NOWETWGNTNODRYWGHT	
POLYCENTRPODIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0.02	0.00262
LIMNEPHILIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
OLIGOCHAETA	2	20	5	1	7 7.64	4	21	3	15	10.7 7.56		8.87 0.04	0.04583	0.00888
HIRUDINIA	0	0	0	0	0 0	0	2	0	0	0.5 0.86		0.25 0.43	0.00674	0.00081
GAMMARIDAE	0	0	0	0	0 0	0	0	0	1	0.25 0.43		0.25 3.26	0.00779	0.00096
DAPHNIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
ASELLIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
SPHAERIIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
UNIONIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
PLANORBIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
HYDRACARINA	0	0	0	0	0 0	2	34	0	10	11.5 13.5		5.75 6.75	0.03946	0.00795
SIALIDAE	0	0	0	0	0 0	0	0	0	0	0 0		0 0	0	0
TOTALS	5	29	6	1	10.2 11.1	22	149	4	38	53.2 59.1		31.8 27.5	0.1622	0.02751
COMBINED SITE AVERAGES AUGUST AND OCTOBER											----- 29.4 19.2 0.32			

Appendix B, continued.

TABLE 14. BENTHOS IN THE ST. JOE RIVER (SITE 65), 31 AUGUST, 1987.

TAXA	8'S				/'S				COMBINED SITES MID AND RB			
	SITE-MID				STD. MEAN DEV	SITE-RB				STD. MEAN DEV.		
	A	B	C	D		A	B	C	D		WET WGHT.	DRY WGHT.
CHIRONOMIDAE	14	5	1	13	8.25 5.44	8	5	8	16	9.25 4.08	8.75 0.68	0.01771 0.00276
CERATOPOGONIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
CHAOBORIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
TABANIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
DIPTERAN PUPA	0	1	0	0	0.25 0.43	1	0	0	0	0.25 0.43	0.25 0	NOWETWGHTNODRYWGHT
ELMIDAE	0	0	0	0	0 0	0	1	0	0	0.25 0.43	0.12 0.21	0.00017 0.00012
HALIPIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
SIPHONURIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
LEPTOCERIDAE	0	0	0	0	0 0	1	0	1	2	1 0.70	0.5 0.35	0.00492 0.00135
PHRYGANEIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
BRACHYCENTRIDAE	0	1	0	0	0.25 0.43	0	0	0	0	0 0	0.12 0.21	NOWETWGHTNODRYWGHT
COENAGRIONIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
HYDROPTILIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
POLYCENTRPODIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
LIMNephilidae	0	4	0	7	2.75 2.94	0	0	0	0	0 0	1.37 1.47	NOWETWGHTNODRYWGHT
OLIGOCHAETA	15	7	21	33	19 9.48	1	6	4	14	6.25 4.81	12.6 2.33	0.02042 0.00345
HIRUDINIA	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
GAMMARIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
DAPHNIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
ASELLIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
SPHAERIIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
UNIONIDAE	0	0	1	8	2.25 3.34	0	1	0	0	0.25 0.43	1.34 1.45	0.01406 0.00873
PLANORBIDAE	0	0	0	0	0 0	0	0	0	0	0 0	0 0	0 0
HYDRACARINA	0	0	0	2	0.5 0.86	0	0	0	0	0 0	0.25 0.43	0.00002 0.00002
SIALIDAE	0	0	0	0	0 0	0	0	1	0	0.25 0.43	0.12 0.21	0.01883 0.00192
TOTALS	29	18	23	63	33.2 22.9	11	13	14	32	17.5 11.3	25.4 7.38	0.07613 0.01835

Appendix B, continued.

TABLE 15. BENTHOS IN THE ST. JOE RIVER (SITE 05), 13 OCTOBER, 1987.

TAXA	I'S							!'S							COMBINED		SITES MID AND RB		
					STD.							STD.			STD.		WET	DRY	
	SITE-MID				MEAN DEV			SITE-RB				MEAN DEV.			MEAN DEV.		WGNT.	WGHT.	
	A	B	C	O				A	B	C	D								
CHIRONOMIDAE	24	0	64	6	23.5	24.9		13	55	30	31	32.2	14.9		27.8	5.01	0.03093	0.0047	
CERATOPOGONIDAE	0	0	1	0	0.25	0.43		0	2	4	1	1.75	1.47		1	0.52	0.00012	0.00038	
CHAOBORIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
TABANIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
DIPTERAN PUPA	0	0	0	0	0	0		0	0	0	0	0	0	'	0	0	0	0	
ELMIDAE	0	0	0	0	0	0		0	0	1	2	0.75	0.82		0.37	0.41	NOWET	WGNT	0.00007
NALIPIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
SIPHONURIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
LEPTOCERIDAE	0	0	0	0	0	0		1	1	0	0	0.5	0.5		0.25	0.25	NOWET	VGNT	0.00001
PHRYGANEIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
BRACHYCENTRIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
COENAGRIONIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
NYDROPTILIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
POLYCENTRPODIDAE	0	0	0	0	0	0		2	2	0	0	1	1		0.5	0.5	0.00927	0.00108	
LIMNEPHILIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
OLIGOCHAETA	1	0	6	2	2.25	2.27		1	0	6	8	3.75	3.34		3	0.53	0.00514	0.00092	
HIRUDINIA	0	0	0	0	0	0		0	1	0	1	0.5	0.5		0.25	0.25	0.00826	0.00072	
GAMMARIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
DAPHNIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
ASELLIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
SPHAERIIDAE	0	0	1	0	0.25	0.43		0	0	0	1	0.25	0.43		0.25	0	0.0026	0.00157	
UNIONIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
PLANORBIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
HYDRACARINA	0	0	0	0	0	0		0	0	0	1	0.25	0.43		0.12	0.21	NOWET	WGHT	0.00013
SIALIDAE	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	
TOTALS	25	0	72	8	26.2	28.1		17	61	41	45	41	23.4		33.6	7.70	0.05632	0.00958	
COMBINED SITE AVERAGES																			
AUGUST AND OCTOBER															29.5		7.54	0.066	0.014

Appendix B, continued.

TABLE 16. BENTHOS IN THE ST. MARIES RIVER (SITE M), 31 AUGUST, 1987.

TAXA	N'S						8'S						COMBINED		SITES MID AND RB	
	SITE-MID			STD. MEAN DEV			SITE-RB			STD. MEAN DEV.			STD. MEAN DEV.		WET YGHT.	DRY WGHT.
	A	B	C	D			A	B	C	D						
CHIRONOMIDAE	0	0	0	1	0.25	0.43	7	7	1	1	4	3	2.12	1.28	0.00587	0.00131
CERATOPOGONIDAE	0	0	0	0	0	0	0	1	0	0	0.25	0.43	0.12	0.21	MOWETWGHT	0.00002
CHAOBORIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TABANIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIPTERAN PUPA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ELMIDAE	0	0	0	0	0	0	0	0	0	1	0.25	0.43	0.12	0.21	NOWETWGHT	0.00015
HALIPIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SIPHONURIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEPTOCERIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHRYGANEIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BRACNYCENTRIDAE	0	0	0	0	0	0	4	0	0	0	1	1.73	0.5	0.86	NOWETWGHTNOORYWGHT	
COENAGRIONIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HYDROPTILIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLYCENTRPODIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LIMNEPHILIDAE	0	0	0	0	0	0	1	3	0	0	1	1.22	0.5	0.61	NOWETWGHTNODRYWGHT	
OLIGOCHAETA	0	0	0	0	0	0	0	7	0	3	2.5	2.87	1.25	1.43	0.01481	0.00266
HIRUDINIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAMMARIDAE	0	0	0	0	0	0	5	0	1	0	1.5	2.06	0.75	1.03	NOIETWGHTNOORYWGH	
DAPHNIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ASELLIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPNAERIIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNIONIDAE	0	0	0	0	0	0	0	0	0	1	0.25	0.43	0.21	0.21	3.6248	2.6503
PLANORBIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HYDRACARIMA	0	0	0	0	0	0	0	0	0	1	0.25	0.43	0.12	0.21	NOWETWONT	0.00013
SIALIOAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	25	0	72	8	26.2	28.1	17	61	41	45	41	23.4	33.6	7.70	0.05632	0.00958
COMBINED SITE AVERAGES													----- '-----			
AUGUST AND OCTOBER													29.5 7.54 0.066 0.014			

Appendix B, continued.

TABLE 17. BENTNOS IN THE ST. MARIES RIVER (SITE M), 13 OCTOBER, 1947.

TAXA	B'S						B'S						COMBINED SITES MID AND RB			
	SITE-MID			STD. MEAN DEV			SITE-RB				STD. MEAN DEV.		STD. MEAN OEV.		WET WGNT.	DRY WGHT.
	A	B	C	D			A	B	C	D						
CHIRONOMIDAE	10	4	17	17	12	5.43	12	1	0	1	3.5	4.92	7.75	0.25	0.08346	0.0108
CERATOPOGONIDAE	0	0	0	1	0.25	0.43	0	0	0	0	0	0	0.12	0.21	NOWETWGNT	0.00004
CHAOBORIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TABANIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIPTERAN PUPA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ELMIDAE	0	0	0	0	0	0	0	0	0	1	0.25	0.43	0.12	0.21	NOWETWGHT	0.00087
NALIPIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SIPHONURIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LEPTOCERIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHRYGANEIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BRACHYCENTRIDAE	0	0	0	0	0	0	1	0	0	0	0.25	0.43	0.12	0.21	NOWETWGNTNCDRYWGHT	
COENAGRIONIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HYDROPTILIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLYCENTRPODIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LIMNEPNILIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OLIGOCHAETA	0	0	2	6	2	2.44	6	3	2	3	3.5	1.5	2.75	0.47	0.05127	0.00654
NIRUDINIA	0	0	0	0	0	0	0	1	0	0	0.25	0.43	0.12	0.21	0.00738	0.00083
GAI ARIOAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAPNNIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ASELLIDAE	0	0	0	0	0	0	0	0.	0	0	0	0	0	0	0	0
SPHAERIIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNIONIDAE	0	0	0	0	0	0	1	0	0	1	0.5	0.5	0.25	0.25	24.97247	17.00516
PLANORBIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HYDRACARINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SIALIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	10	4	19	24	14.2	8.31	20	5	2	6	8.25	8.22	11.2	1.84	25.11458	17.02424
COMBINED SITE																
AUGUST AND OCTOBER													8.77 4.37 14.383 9.84			

Appendix B, continued.

TABLE 18. SUMMARY BENTHOS NUMBERS AND WEIGHTS ST. JOE AND ST MARIES RIVERS
AUGUST AND OCTOBER, 1987.

	MEAN		WET	DRY
COMBINED MID & RB	9.25	9.28	0.236	0.075

#2 OCTOBER				
COMBINED MID & RB	20.0	16.8	0.210	0.040

COMBINED AUG. AND OCT.				
MID & RB	14.6	13	0.224	0.058

ST. JOE #3 AUGUST				
COMBINED MID & RB	27	10.9	0.478	0.040

#3 OCTOBER				
COMBINED MID & RB	31.8	27.5	0.162	0.027

COMBINED AUG. AND OCT.				
MID & RB	29.4	19.2	0.32	0.034

ST. JOE #5 AUGUST				
COMBINED MID & RB	25.4	7.38	0.076	0.018

#5 OCTOBER				
COMBINED MID & RB	33.6	7.70	0.056	0.009

COMBINED AUG. AND OCT.				
MID & RB	29.5	7.54	0.066	0.014

ST. MARIES M AUGUST				
COMBINED MID & RB	6.34	6.90	3.653	2.656

M OCTOBER				
COMBINED MID & RB	11.2	1.84	25.114	17.024

COMBINED AUG. AND OCT.				
MID & RB	8.77	4.37	14.383	9.84

Appendix B, continued.

Table 19. St Joe and St Maries Rivers limnological data, 31 August and 13 October, 1987.

Site M (St. Maries River), 31 August, 1987.

Depth (M)	SM from Left Bank			Mid- Channel			SM from Right Bank				
	O2	Temp	Cond	O2	Temp	Cond	O2	Temp	Cond		
	(mg/l)	(C)	(umho)	(mg/l)	(C)	(umho)	(mg/l)	(C)	(umho)		
0	8.1	19.4	51	8.2	19	51	8.4	19	51	Time:	0830-
1	8	18.8	51	8.15	19	52	8.3	19	51	Turbidity (NTU):	1.6
2	8.1	19	52	8.1	19	52	8.3	19		pH:	7.44
3	7.4	18	52	7.65	18.5	53				Alkalinity (mg/l):	34
4				6.7	18	55				Chlorophyll a (ug/l):	4.39
5				5.2	17.5	73				Mid Channel PCT OM:	2.1
6				3	17.4	72				Right Bank PCT OM:	1.9
7											
Depth:3.5-4.1m			Depth:6.3m			Depth:1.3m					
Secchi2.35m			Secchi2.8m			Secchi>1.3m					

Site 5 (St. Joe, above St. Maries), 31 August, 1987.

Depth (M)	SM from Left Bank			Mid- Channel			SM from Right Bank				
	O2	Temp	Cond	O2	Temp	Cond	O2	Temp	Cond		
	(mg/l)	(C)	(umho)	(mg/l)	(C)	(umho)	(mg/l)	(C)	(umho)		
0	8.5	19	59	8.6	19	185 ?	8.5	19	58	Time:	1050-
1	8.45	18.5	59	8.5	18.4	185	8.45	18.9	58	Turbidity (NTU):	1.1
2	8.4	18.5	60	8.5	19.3	190	8.4	18.9	58	pH:	7.71
3	8.4	18.5	62	8.45	19.3	191				Alkalinity (mg/l):	37
4				8.4	18	195				Chlorophyll a (ug/l):	2.15
5				8.3	18	206				Mid Channel PCT OM:	2.5
6				8.3	17.8	206				Right Bank PCT OM:	1.6
7				8.2	17.7	206					
8				8.05	17.6	207					
9				6.55	16.5	207					
10				5.7	16.1	206					
Depth:3.3m			Depth:10.5m			Depth:1.5m					
Secchibottom			Secchi5.25m			Secchibottom					

Remarks: Mid-channel conductivities seem exceedingly high.
 Checked just above confluence with St. Maries.
 From surf to 8 meters deep, conductivities were
 66, 69, 71, 72, 73, 81, 85, 86, and 87 umhos.

Appendix B, continued.

Table 19 (cont.). St Joe and St Maries Rivers limnological data, 31 August and 13 October, 1987.

Site 3 (St. Joe, below St. Maries), 31 August, 1987.

Depth (M)	5M from Left Bank			Mid- Channel			5M from Right Bank				
	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)		
0	8	21.4	69	8.4	21	60	8.2	21.4	51	Time:	1320-
1	7.95	19.7	69	8.3	19.5	67	8.45	20.3	51	Turbidity (NTU):	1.6
2	7.9	19.3	70	8.2	19	70	8.85	19.2	53	pH:	7.53
3	7.85	19.3	73	8.1	18.6	70				Alkalinity (mg/l):	34
4				7.9	18.5	71				Chlorophyll a (ug/l):	3.05
5				7.75	18.3	82				Mid Channel PCT OM:	3.2
6				7.1	18	82				Right Bank PCT OM:	3.7
7				6.6	17.7	82					
8				6.5	17.7	82					
9				6.3	17.6	82					
10				5.65	17.5	82					
11				5	17.5	81					
11.5				4.1	17.4	82					
Depth:3.3m SecchiBottom			Depth: Secchi:			Depth:1.5m SecchiBottom					

Site 2 (St. Joe, below Mission Point), 31 August, 1987.

Depth (M)	5M from Left Bank			Mid- Channel			5M from Right Bank				
	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)		
0	9.1	22.4	63	8.05	21.7	63	8.5	21.5	61	Time:	1530-
0.5	9.05	21.7	65	8	20.5	68	8.65	20.8	68	Turbidity (NTU):	0.9
2				8	19.5	71	8.75	20.5	70	pH:	7.44
3				7.9	19.4	72				Alkalinity (mg/l):	35
4				7.6	19	72				Chlorophyll a (ug/l):	5.80
5				7.3	18.5	84				Mid Channel PCT OM:	0.5
6				6.8	18.5	85				Right Bank PCT OM:	2.4
7				6.3	18.5	86					
8				6.2	18.5	87					
9				6.2	18.5	89					
10				8.4							
11											
11.5											
Depth:.5m			Depth: 8.4			Depth:1.75m					
SecchiBottom			Secchi 2.9			SecchiBottom					

Appendix B, continued.

Table 19 (cont.). St Joe and St Maries Rivers limnological data, 31 August and 13 October, 1987.

Site M (St. Maries River) 13 October, 1987.

Depth (M)	15M from Left Bank			Mid- Channel			5M from Right Bank			
	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)	
0	9	9.8	53	9	9.1	50	9	9.2	51	Time: 0930, 0845, 0745
1	8.9	9.7	54	9	9.3	51	9	9.2	51	Turbidity (NTU): 1
2	8.9	9.7	54	8.9	9.4	51	9	9.2	52	pH: 6.35
3	8.8	9.7	56	8.9	9.7	51	9	9.3	52	Alkalinity (mg/l): 43
4				8.8	9.8	52				Chlorophyll a (ug/l): 1.77
5				8.8	9.9	63				Mid Channel PCT OM:
6				8.8	9.9	63				Right Bank PCT OM: 8.5
7										
Depth: 3.5-4.1m			Depth: 6.4			Depth: 3.5				
Secchi: 2.3			Secchi: -			Secchi: -				

Site 5 (St. Joe, above St. Maries), 13 October, 1987.

Depth (M)	15M from Left Bank			Mid- Channel			5M from Right Bank			
	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)	
0	9.7	10.3	54	9.6	8.9	50	9.7	8.5	50	Time: 1020
1	9.7	9.5	55	9.6	8.6	50	9.7	8.5	50	Turbidity (NTU): 0.6
2	9.7	9.2	58	9.6	8.5	51	9.6	8.5	50	pH: 6.25
3				9.6	8.5	51				Alkalinity (mg/l): 42
4				9.5	8.5	52				Chlorophyll a (ug/l): 1.52
5				9.6	8.5	59				Mid Channel PCT OM:
6				9.6	8.5	59				Right Bank PCT OM:
7				9.6	8.5	65				Carbon Dioxide (mg/l): 7
8				9.5	8.7	68				
9				9.5	8.8	68				
10				9.5	8.8	68				
Depth: 2.3			Depth: 9.5			Depth: 1.5				
Secchi: Bottom			Secchi: 4.3			Secchi: Bottom				

Appendix B, continued.

Table 19 (cont.). St Joe and St Maries Rivers limnological data, 31 August and 13 October, 1987.

Site 3 (St. Joe, below St. Maries), 13 October, 1987.

Depth (M)	SM from Left Bank			Mid- Channel			SM from Right Bank			
	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)	
0	8.6	11.9	58	8.6	11	60	8.5	12	59	Time: 1300, ?, ?
1	8.6	11.7	60	8.7	10	60	8.5	11.9	59	Turbidity (NTU): 0.7
2				8.7	9.5	61				pH: 6.1
3				8.7	9.5	62				Alkalinity (mg/l): 47
4				8.7	9	66				Chlorophyll a (ug/l): 0.80
5				8.6	9	71				Mid Channel PCT OM:
6				8.6	9.2	76				Right Bank PCT OM:
7				8.6	9	77				Carbon Dioxide (mg/l): 4.7
8				8.6	9.5	78				
9				8.5	9.5	78				
10				8.5	9.5	79				
11				8.5	9.5	80				
11.5										

Depth: 1.5
Secchi: Bottom

Depth: 11.1
Secchi: 3.2

Depth: 1
Secchi: Bottom

Site 2 (St. Joe, below Mission Point , 13 October, 1987.

Depth (M)	SM from Left Bank			Mid- Channel			SM from Right Bank			
	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)	O2 (mg/l)	Temp (C)	Cond (umho)	
0	8.7	12.9	80	8.2	13.3	76	8.4	13	85	Time: 1500
1	8.5	12.5	82	8.2	13.2	80	8.4	12.2	90	Turbidity (NTU): 0.95
2				8.2	12.4	80				pH: 6
3				8.2	12.2	81				Alkalinity (mg/l): 42
4				8.1	12.1	81				Chlorophyll a (ug/l): 2.33
5				8	12	88				Mid Channel PCT OM:
6				8	12	92				Right Bank PCT OM:
7				7.9	11.9	92				Carbon Dioxide (mg/l): 8
8				7.7	12	92				
9										
10										
11										
11.5										

Depth: 1.5
Secchi: Bottom

Depth: 8.2
Secchi: 2.5

Depth: 1.5
Secchi: Bottom

Appendix B, continued.

Table 20. St Joe and St Maries Rivers nutrient analyses, 31 August and 13 October 1987.

Three bottles were collected at each site (A, B, and C) and
 *three samples were analyzed from each bottle. There are, then, three
 replicates of lab variability and three of collection variability.

31 August, 1987

SITE	NITRATE NITROGEN (ug/l)					KJELDAHL NITROGEN (mg/l)					TOTAL PHOSPHORUS (mg/l)				
	#1	#2	#3	Mean	STD	#1	#2	#3	Mean	STD	#1	#2	#3	Mean	STD
#2	A	13	9	6	9	2.80	0.10	0.14		0.12	0.020	0.014	0.008	0.012	0.0025
	B	9	9	13	10	1.62	0.24	0.20		0.22	0.020	0.023	0.026	0.035	0.0051
	C	9	9	6	8	1.62	0.14	0.12		0.13	0.010	0.024	0.024	0.020	0.0019
	Mean	10	9	8	9.1		0.16	0.15	ERR	0.157		0.020	0.019	0.022	0.0207
	STD	1.62	****	3.23		2.29	0.06	0.03	ERR		0.048	0.00	0.01	0.01	0.0078
#3	A	16	23	13	17	4.29	0.16	0.16		0.16	0.000	0.024	0.029	0.024	0.0024
	B	23	13	19	18	4.29	0.22	0.20		0.21	0.010	0.023	0.024	0.023	0.0005
	C	26	13	13	17	6.48	0.12	0.12		0.12	0.000	0.018	0.023	0.018	0.0024
	Mean	22	16	15	17.5		0.17	0.16	ERR	0.163		0.022	0.025	0.022	0.0229
	STD	4.28	4.86	3.24		5.15	0.04	0.03	ERR		0.037	0.00	0.00	0.00	0.0031
#5	A	9	6	2	6	2.80	0.14	0.12		0.13	0.010	0.006	0.012	0.012	0.0028
	B	13	19	13	15	3.24	0.10	0.10		0.10	0.000	0.016	0.024	0.012	0.0050
	C	5	5	5	5	0.00	0.14	0.14		0.14	0.000	0.004	0.002	0.007	0.0021
	Mean	9	10	7	8.5		0.13	0.12	ERR	0.123		0.009	0.013	0.010	0.0106
	STD	3.04	6.61	4.34		5.10	0.02	0.02	ERR		0.018	0.01	0.01	0.00	0.0064
#M	A	23	16	23	21	3.24	0.20	0.28	0.28	0.25	0.038	0.020	0.023	0.021	0.0012
	B	43	33	30	35	5.84	0.24	0.20		0.22	0.020	0.023	0.026	0.035	0.0051
	C	26	30		28	1.72	0.18	0.22		0.20	0.020	0.024	0.043	0.035	0.0078
	Mean	31	26	26	28.0		0.21	0.23	0.28	0.229		0.022	0.031	0.030	0.0278
	STD	9.01	7.42	3.43		7.68	0.02	0.03	0.00		0.037	0.00	0.01	0.01	0.0075

13 October, 1987

SITE	NITRATE NITROGEN (ug/l)					KJELDAHL NITROGEN (mg/l)					TOTAL PHOSPHORUS (mg/l)				
	#1	#2	#3	Mean	STD	#1	#2	#3	Mean	STD	#1	#2	#3	Mean	STD
#2	A	19	19	19	0.00	0.14	0.16	0.14	0.15	0.009	0.012	0.017	0.014	0.014	0.0021
	B	29	33	33	32	1.63	0.12	0.14	0.12	0.13	0.009	0.008	0.010	0.010	0.0009
	C	12	5	12	10	3.26	0.16	0.14	0.14	0.15	0.009	0.012	0.014	0.016	0.0016
	Mean	20	19	21	20.1		0.14	0.15	0.13	0.140		0.011	0.014	0.013	0.0126
	STD	7.09	11.3	8.61		9.21	0.02	0.01	0.01		0.013	0.00	0.00	0.00	0.0028
#3	A	40	47	40	42	3.26	0.10	0.10	0.12	0.11	0.009	0.018	0.012	0.016	0.0025
	B	22	22		22	0.00	0.12	0.13		0.12	0.003	0.014	0.012	0.014	0.0009
	C	9	26		17	8.63	0.16	0.16		0.16	0.000	0.014	0.016	0.012	0.0016
	Mean	24	32	40	29.3		0.13	0.13	0.12	0.126		0.015	0.013	0.014	0.0142
	STD	12.7	10.7	0.00		12.24	0.02	0.02	0.00		0.023	0.00	0.00	0.00	0.0020

Appendix B, continued.

Table 20 (cont.). St Joe and St Maries Rivers nutrient analyses, 31 August and 13 October, 1987.

13 October, 1987 (cont.)

SITE	NITRATE NITROGEN (ug/l)					KJELDAHL NITROGEN (mg/l)					TOTAL PHOSPHORUS (mg/l)				
	#1	#2	#3	Mean	STD	#1	#2	#3	Mean	STD	#1	#2	#3	Mean	STD
#5	A	9	15	5	10	4.31	0.08	0.04	0.08	0.07	0.019	0.005	0.012	0.004	0.007
	B	14	15	9	13	2.95	0.06	0.06	0.08	0.07	0.009	0.018	0.000	0.003	0.007
	C	9	15	15	13	3.25	0.10	0.10	0.08	0.09	0.009	0.014	0.016	0.013	0.014
	Mean	10	15	10	11.8		0.08	0.07	0.08	0.076		0.012	0.009	0.007	0.0094
	STD	2.44	****	4.31		3.86	0.02	0.02	0.00		0.018	0.01	0.01	0.00	0.0061
#M	A	33	26	31	30	2.92	0.18	0.20	0.18	0.19	0.009	0.018	0.029	0.024	0.024
	B	26	26	29	27	1.63	0.16	0.18		0.17	0.010	0.028	0.018	0.028	0.025
	C	33	29	36	33	2.82	0.20	0.20	0.22	0.21	0.009	0.029	0.018	0.022	0.023
	Mean	31	27	32	30.0		0.18	0.19	0.20	0.190		0.025	0.022	0.025	0.0238
	STD	3.36	1.53	2.88		3.45	0.02	0.01	0.02		0.017	0.00	0.01	0.00	0.0046

		NO3	TKN	TP
#2	Mean w/in bottle STD:	2.0	0.02	0.003
	Overall STD:	2.3	0.05	0.008
#3	Mean w/in bottle STD:	5.0	0.00	0.004
	Overall STD:	5.2	0.04	0.003
#5	Mean w/in bottle STD:	2.0	0.00	0.003
	Overall STD:	5.0	0.02	0.006
#M	Mean w/in bottle STD:	3.6	0.03	0.005
	Overall STD:	7.7	0.04	0.007

Appendix B, continued.

Table 21. Periphyton (attached benthic algae) from the St Joe and St Maries Rivers,
31 August - 13 October, 1987

	Volume Settled* (ml)	Davis' Results (ml)	From Glass Slides				From Wood Stakes			
			Dry Weight (mg/cm2)	LOI (mg/cm2)	Percent LOI (Trichr)	Chl a (mg/m2)	Dry Weight (g/m2)	LOI (g/m2)	Percent LOI	Chl a (ug/l)
#2	3.1	1.5	12.9	2.25	17.44%	18.37	3.61	0.8	22.16%	26.11
#3	N/A	2.9	N/A	N/A	N/A	N/A	0.996	0.363	36.45%	17.96
#5	2.1	3.0	2.87	0.44	15.33%	30.68	0.577	0.23	39.86%	10.79
#M	N/A	2.8	N/A	N/A	N/A	N/A	5.05	0.47	9.31%	16.88

*From scrapings from glass microscope slides (top and bottom), as per Davis, 1967.

Settled two days, incubated 43 (Davis incubated 40 days). Upon centrifuging, volume was 0.5 and 0.33 ml in the site 2 and site 5 samples, respectively.

SITE	REP	CHL	Ashed wt	Dry wt	filter wt	Area cm2	Corr Dry (mg/cm2)	Corr Ash	%LOI
5-Slide	1	27.23	0.1184	0.12656	0.0894	18.75	1.981866	1.546666	21.96%
5-Slide	2	37.71	0.15584	0.1647	0.08874	18.75	4.0512	3.578666	11.66%
5-Slide	3	27.11	0.13082	0.13859	0.0905	18.75	2.5648	2.1504	16.16%
5-Jar			0.09908	0.10581	0.08893	24	0.533904	0.321038	39.87%
3-Jar			0.10584	0.11455	0.09064	24	0.99625	0.633333	36.43%
M-Jar			0.20129	0.21255	0.09136	24	5.049583	4.580416	9.29%
2-Jar			0.15681	0.17614	0.08942	24	3.613333	2.807916	22.29%
2-Slide			0.42599	0.49692	0.08915	31.61612	12.89753	10.65405	17.39%
5 - MEAN		30.68333					2.865955	2.425244	16.59%

Appendix B, continued.

Table 22. Numbers (per L) and biovolume (mm³/L) of algae genera collected
31 August, 1987.

Algae Genera	St. Joe Site 2		St. Joe Site 3		St. Joe Site 5		St. Maries Site M	
	Number	Vol	Number	Vol	Number	Vol	Number	Vol
Melosira	5922	0.012	10660	0.021	5330	0.011	47970	0.095
Dinobryon	112522	0.212	10660	0.020	18655	0.035	125255	0.236
Cryptomonas	2961	0.000	10660	0.002	31980	0.005	82615	0.012
Gomphonema	56261	0.288	38642	0.198	77285	0.395	29315	0.150
Tabellaria	29611	0.155	26650	0.140	66625	0.350	10660	0.056
Amphora e	2961	0.015	5330	0.027			2665	0.014
Scenedesmus	35533	0.004	5330	0.001			10660	0.001
Synedra			18655	0.009	23985	0.012	18655	0.009
Ankistrodesmus	14806	0.000	5330	0.000	18655	0.000	13325	0.000
Pediastrum e	trace						2665	0.000
Pinnularia	2961	0.013	13325	0.059			10660	0.047
Aphanizomenon							15990	
Gloeocystis e							10660	0.002
Cymbella e	8883	0.045	10660	0.054	7995	0.041	2665	0.014
Navicula e	trace		2665	0.001			trace	
Cyclotella							trace	
Nostoc e	20728	0.022						
Ulothrix			trace					
Fragillaria			17322	0.012				
Diatomella			trace					
TOTAL	293,149	0.766	175,889	0.544	250,510	0.848	383,760	0.636
Rotifers								
Lindia								
Polyarthra							20	N/A

e Biovolumes are estimates.

Table 23. Numbers (per L) and biovolume (mm³/L) algae genera collected
13 October, 1987.

Algae Genera	St. Joe		St. Joe		St. Joe		St. Maries	
	Site 2		Site 3		Site 5		Site M	
	Number	Vol	Number	Vol	Number	Vol	Number	Vol
Melosira	111042	0.221	26650	0.053	17767	0.035	26650	0.053
Dinobryon	trace		302033	0.569	8883	0.017	trace	0.000
Cryptomonas	146575	0.022	17767	0.003	5922	0.001	189215	0.028
Gomphonema	88833	0.454	159900	0.817	112522	0.575	47970	0.245
Tabellaria	48858	0.257	142133	0.746	56261	0.295	26650	0.140
Amphora e	4442	0.023	8883	0.045	5922	0.030	5330	0.027
Scenedesmus	35533	0.004	35533	0.004	trace	0.000	21320	0.002
Synedra	31092	0.015	62183	0.031	50339	0.025	7995	0.004
Ankistrodesmus	31092	0.000	26650	0.000	trace	0.000	13325	0.000
Pediastrum					trace			
Pinnularia	8883	0.039	trace		2961	0.013	5330	0.024
Cymbella	22208	0.114	26650	0.136	17767	0.091	2665	0.014
Navicula e	4442	0.002			29611	0.013		
Oocystis							26650	0.009
Nostoc e	trace				35533	0.037	trace	
Ulothrix	319800	0.096			32572	0.010	trace	
Fragillaria	8883	0.006					trace	
Diatomella								
TOTAL	861,683	1.252	808,382	2.405	376,060	1.142	373,100	0.545
Rotifers								
Lindia	67	N/A			67	N/A		
Polyarthra					67	N/A	140	N/A

e Biovolumes are estimates.

Submitted by:

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Michael Mahan
Fishery Technician

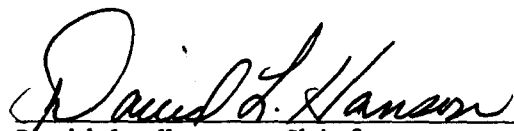
William D. Horton
Fishery Staff Biologist

Approved by:

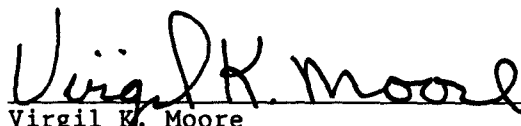
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